JULY, 1961

Plant Engineering®

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The magazine that helps plant engineers with their everyday problems

Volume 15, No. 7 Circulation of this issue 52,170

Square D TOTALLY ENCLOSED Duct*

takes less space—*and costs no more*

*(low impedance)

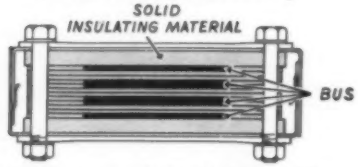
Ventilated bus duct is bulky and awkward. It's difficult—sometimes impossible—to install it in restricted areas. The layers of insulation around the bus bars and the necessary air spaces contribute to large, inconvenient size.

Square D totally enclosed feed-in duct solves the space problem. Solid sheets of insulation permit mounting bus bars only ¼" apart. This solid insulating material is also an effective heat conductor, thus eliminating the need for air spaces. The result—Square D low-impedance duct is as much as 50% smaller than ordinary duct. It can be used where no other duct fits. It makes expansion of existing electrical systems easier, new construction planning simpler. Best of all, Square D low-impedance bus duct is totally enclosed. Having no ventilation holes, it's safe from physical damage and dust accumulation. Needing no ventilation, it can be mounted in any position without de-rating.

Doesn't it make sense, when buying feed-in duct, to specify a product that will meet all your requirements? Square D totally enclosed low-impedance duct costs no more—why settle for less?

Here's Why Square D's EXCLUSIVE Design

makes ventilation and increased bus bar size unnecessary



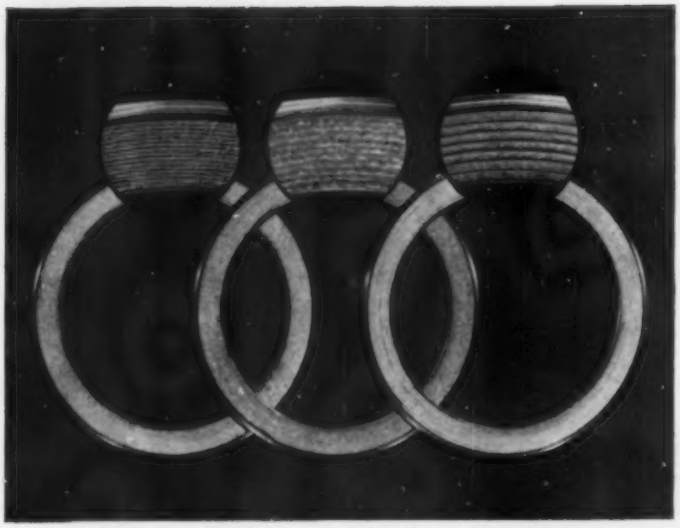
The entire space within the duct and between the bus bars is filled with a solid insulating material which conducts the heat to the surface. There are no dead air spaces inside the duct. Square D totally enclosed low-impedance duct meets U/L requirements for temperature rise with no larger bus bars (hence, no higher cost) than ventilated duct.

SQUARE D COMPANY

wherever electricity is distributed and controlled

Circle 501 on postcard, page 33

ENGINEERED GASKETS
for Plant Maintenance



Exacting control of gasket density is obtained by varying the number of metal plies and filler material to seal a specific pressure.

Controlled density is the reason why Garlock *Guardian Gaskets offer you unusual sealing ability.** A series of V-shaped metal plies alternated with layers of filler form the "body" of GUARDIAN spiral-wound gaskets. The proper selected thickness of filler material and preformed metal, the number of laminations of filler and metal and the correct tension of filler and metal while being formed into a gasket are factors engineered to achieve the proper gasket density.

This controlled density—combined with the special V-shaped metal plies—allows the gasket to "breathe." Thus, a tight seal is effected at all times despite equipment or line expansion and contraction. In no other type of gasket is it possible to vary the compressibility to meet different pressure and bolt load requirements.

Complete range of sizes, and shapes and wide temperature range is another reason for specifying Garlock GUARDIAN Gaskets . . . 1/16" thickness up to 6", 1/8" up to 30", .175" up to 60" and 1/4" thick up to 60" depending on flange width. For temperatures up to +1900°F. with ceramic filler material.

Type CR GUARDIAN Gaskets are furnished with a cadmium plated centering ring for corrosion resistance and prolonged shelf life. Centering ring also is marked with the pressure series —assuring application of correct gasket density for specific pressure.

Convenient local stocks of most standard sizes are maintained at Camden, New Jersey, Cleveland, Ohio, Houston, Texas and San Francisco, California, for quick delivery.

GARLOCK

Find out more from your Garlock representative at the nearest of the 26 Garlock sales offices throughout the U. S. and Canada, or write for catalog AD-176, Garlock Inc., Palmyra, N. Y.
Canadian Div.: Garlock of Canada Ltd.
Plastics Div.: United States Gasket Co.

Order from the Garlock 2,000... two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*Registered Trademark

Circle 502 on postcard, page 33

Plant Engineering July 1961, Volume 15, No. 7

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Sales and Business Staff Personnel listed on Advertisers' Index page

'ROUND ABOUT with the editors

Edited by R. L. Marinello

Plant Layout Work Course

THE SIXTH Annual Midwest Work Course on Plant Layout and Facilities Planning will be held from September 18 through the 23. It will be held at the University of Kansas Extension Center, Kansas City, Kansas.

All phases of plant layout and facilities planning will be discussed at this one-week seminar. Attendees will have an opportunity to present their own plant problems to the group at the clinic-conference sessions.

Further information may be obtained by writing to Edward S. Avison, Assistant Manager, Extension Center, University of Kansas, 39th & Rainbow Blvd., Kansas City 12, Kans.

Home Study Welding Course

GETTING GOOD quality welds is a desire of all plant engineers, and to assist them in training their weldors is a new specialized home study course on "Weld Quality Control and Inspection."

The course consists of 14 lessons, covering everything from the basic concepts to codes, specs, and standards, to arc weld faults, radiography, and ultrasonic inspection.

For more information on this home study course for fabricators and weldors, write to R. E. Taylor, Director, National Technical Training Services, 260 Delaware Ave., Buffalo 2, N. Y.

Plant Engineering Introduces Ken Lawson

PLANT ENGINEERING has added another member to its editorial staff—**Kenneth D. Lawson.**

Before coming to PLANT ENGINEERING, Ken was manager of the plant engineering department of Radio Corporation of America, Findlay, Ohio, since February, 1955. His experience covers industrial staff assignments as facilities standards engineer and administrator of maintenance and operating standards. Operational positions held were manager of construction, maintenance and engineering services and plant engineer.

He holds a B.S. degree in mechanical engineering from Iowa State University and is a member of Pi Tau Sigma. He is a registered professional engineer in Ohio. Professional engineering societies in which he holds membership include the American Institute of Plant Engineers, and the National Society of Professional Engineers. He is the current president of the Ohio Northern Chapter of the Ohio Society of Professional Engineers.

Engineering Appointment

Walter E. Benoit has been named works engineer at Westinghouse Electric Corporation's atomic equipment department at Cheswick, Pa.

He was formerly supervisor of engineering and drafting for building construction and subcontracting at the Bettis atomic power laboratory. He will be responsible for all land and buildings for both the atomic equipment department and the adjoining atomic fuel department.

A native of Springfield, Mass., he received his bachelor of science degree in civil engineering from the University of Delaware and is attending advanced studies in business administration at Carnegie Institute of Technology.

Retirement–Promotion at WE

Harold V. Schmidt, who directed Western Electric Company's $370,000,000 nation-wide building and construction program over the past nine years, has retired as vice president, plant design and construction.

Mr. Schmidt, a native of Muscatine, Iowa, joined the company in 1917 as a

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BPA NBP

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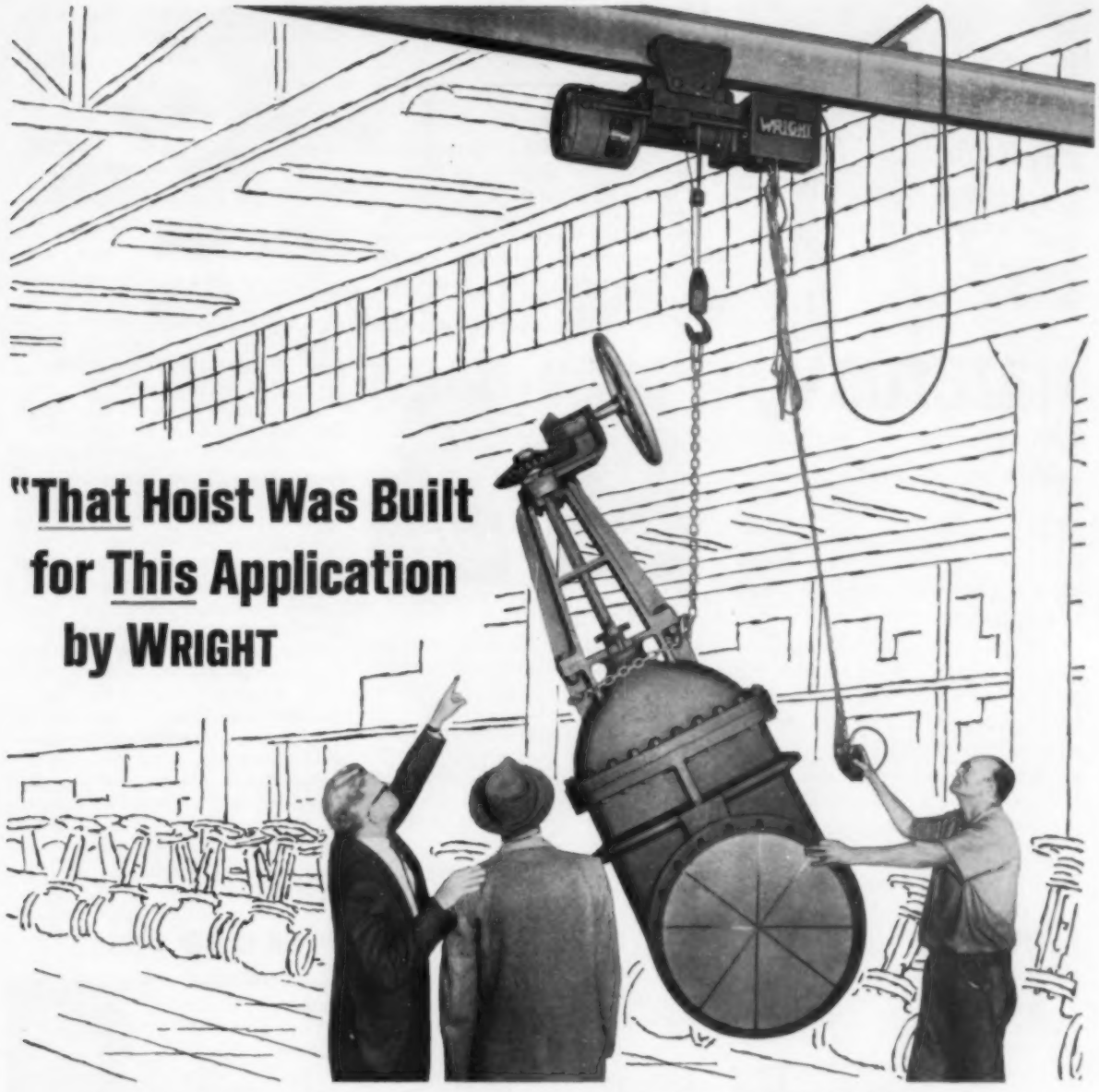

"That Hoist Was Built for This Application by WRIGHT

"This new W-1 Electric Hoist can be built to your exact job requirements. You can get it in capacities from 1 to 3 tons. For close headroom, ask for WH-1, in capacities 1 to 2 tons.

"Wright's overload cut-off can be had on both models. It gives you 3-way protection of operator, load and hoist. Our hoists are factory tested at 50% above rated capacity before overload cut-off is installed.

"These are the hoists to buy for handling efficiency, low maintenance cost, long service life."

STRONG W-1 SPEEDWAY FEATURES

- **MOTORS**—Fully enclosed, ball bearing type. Built to NEMA specifications and rated on basis of 30-minute duty cycle.
- **BEARINGS**—Anti-friction, precision ball or roller bearings support both ends of all shafts. They are mounted in splash oil lubricated gear chamber.
- **MOTOR BRAKE**—External expanding jaw, self-adjusting cam type; operated by solenoid.
- **DRUM**—Fabricated all-steel construction with liberal drum to cable diameter ratio to reduce wear and cable fatigue.

See your WRIGHT distributor for complete information about the W-1 or write us at York, Pa.

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Wright Hoist Division • American Chain & Cable Company, Inc.

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Circle 503 on postcard, page 33

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Fire Hazards

with

Stonehouse Signs

Alert every man in your plant to potential fire dangers with bright, easy-to-see FIRE PREVENTION SIGNS from STONEHOUSE.

All Stonehouse Signs are designed and manufactured to accomplish this purpose in the most effective manner. They are of the highest quality workmanship and materials and comply fully with American Standard Specifications.

Hundreds of different stock-worded accident-prevention signs are available for prompt shipment. Usually the same day your order is received.

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Stonehouse SIGNS

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Circle 504 on postcard, page 33

'ROUND ABOUT

student engineer after graduating from Iowa State College where he majored in electrical engineering. He subsequently worked in a variety of manufacturing and engineering assignments and, in 1952, assumed responsibility for the company's plant design and construction operations.

He was elected a vice president and

H. V. Schmidt

W. J. Tietz

appointed chief engineer in 1956 and one year later was named vice president of the plant design and construction division.

William J. Tietz will succeed him as manager of plant design and construction. He will be responsible for the design and construction phases of the company's building program throughout the country.

He is a native of Chicago and a graduate of the University of Illinois. He joined the company in 1915 as a process inspector and since then has devoted his career to manufacturing engineering. He has been engineer of manufacture for the company's Hawthorne Works, Chicago, since 1959.

Southeastern Plant Engineering and Maintenance Seminar

THE THIRD annual Southeastern Plant Engineering and Maintenance Seminar will be held at the Greensboro War Memorial Coliseum, Greensboro, N. C., from September 12 to the 14. This seminar is sponsored by the three state chapters—Piedmont, Smoky Mountain and Triangle—of the American Institute of Plant Engineers.

It will be held concurrently with the Third Southeastern Show where the latest in industrial equipment will be exhibited.

At the seminar, such areas of interest as training personnel, maintenance procedures, maintenance forces, good housekeeping, safety and economy will be discussed by prominent speakers. In addition, general meetings will be conducted where various groups will talk over ideas and problems pertaining to their own types of industries.

For further information about the conference or show, send your request to John Harden Associates, P.O. Box 3173, Greensboro, North Carolina.

Wire Cloth Standard

MANY WIDELY used types and grades of industrial wire cloth are now covered by a Commercial Standard recently issued by the Commodity Standards Division, U. S. Department of Commerce.

The standard gives the sizes, types and other significant requirements for industrial wire cloth used for general purposes and for applications requiring certain heavier grades. It also establishes certain trade practices and principles of manufacture to promote better quality and uniformity in the product, and a clearer understanding of its significant features, for the mutual benefit of all concerned.

This standard was developed with the cooperation of the Industrial Wire Cloth Institute, and became effective October 1, 1960, after being endorsed by producers, distributors, users and others interested.

Copies of Commercial Standard CS232-60, Industrial Wire Cloth, are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 10 cents each.

New Job for Plant Engineer

Andrew F. Shoemaker has joined the Callery Chemical Company's Muskogee, Oklahoma, high energy fuel plant as plant engineer. He has had extensive domestic and international experience in the chemical industry.

He was plant engineer at the Sunbright plant of Foote Mineral Company in Duffield, Virginia. He began his engineering career as a steam testman for the Baltimore Gas and Electric Company. In 1946 he joined Esso Standard Oil Company and was successively assigned to various Esso affiliates in South America, Sumatra, Japan and South Africa.

A 1937 graduate of Baltimore Polytechnic Institute, he received his bachelor of science degree in mechanical engineering at Johns Hopkins University in 1940.

CLIMAX MOLYBDENUM

Molysulfide® News Digest

CLIMAX MOLYBDENUM COMPANY, a division of American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N.Y.

RECENT TEST SHOWS MORE PROOF OF MoS_2's LOAD-CARRYING ABILITY

New Teflon-MoS_2 Bearing Component Withstands Temperatures Up To 575°F

A new precision ball bearing, which operates at temperatures up to 575°F and needs no conventional lubrication, is now coming off the lines at the Barden Corporation's plant in Danbury, Conn. Trade-named BAR-TEMP, the new bearing utilizes a ball retainer of reinforced Teflon compounded with "Moly" lubricant. Resistance to deformation is much higher than that of pure Teflon*. Also, the material serves as a *dry lubricant*. As the bearing rotates, microscopic amounts of Molysulfide rub off and are deposited on the raceways. Result: long bearing life at temperatures where conventional lubricants fail.

Successful applications include synchros, fans, motors, blowers, barometic pressure switches, tachometer generators, and other devices operating from 1,000 to 24,000 rpm, at temperatures ranging from –100°F to 575°F.

*T.M. E. I. du Pont de Nemours & Co., Inc.

When writing, refer to CL-105

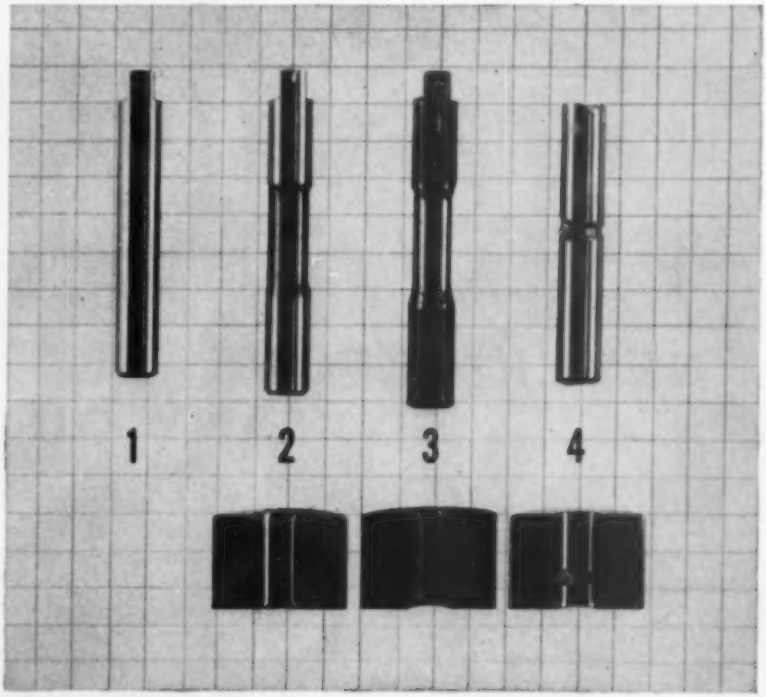
"Moly" GIVES WIRE ROPE 45% MORE BENDING LIFE

That's the forthright verdict of one of the leading wire rope manufacturers, which recently tested its MoS_2-lubricated wire rope against four other leading brands. Fatigue tests and field tests demonstrated the rope's ability to outlast other premium wire ropes in service.

Used as an ingredient in wire drawing compound, Molysulfide creates a micro-shield around each wire. This smooths out minute surface imperfections and prevents the wires from grinding together as the rope flexes. Result: reduction of internal friction —better resistance to fatigue—far longer rope life.

When writing, refer to CL-106

From the German laboratory of Alpha Molykote Corporation comes new proof of Molysulfide's® ability to resist galling and seizing at pressures beyond the yield point of most metals. Previous tests have shown that MoS_2 sustains loads up to 475,000 psi. In this Almen Wieland test, similar to the Falex test, a ¼" pin actually extruded *without any surface damage* at pressures of 100,000 psi, while similar pins using other lubricants were torn, galled or "frozen" to the point of breakage.

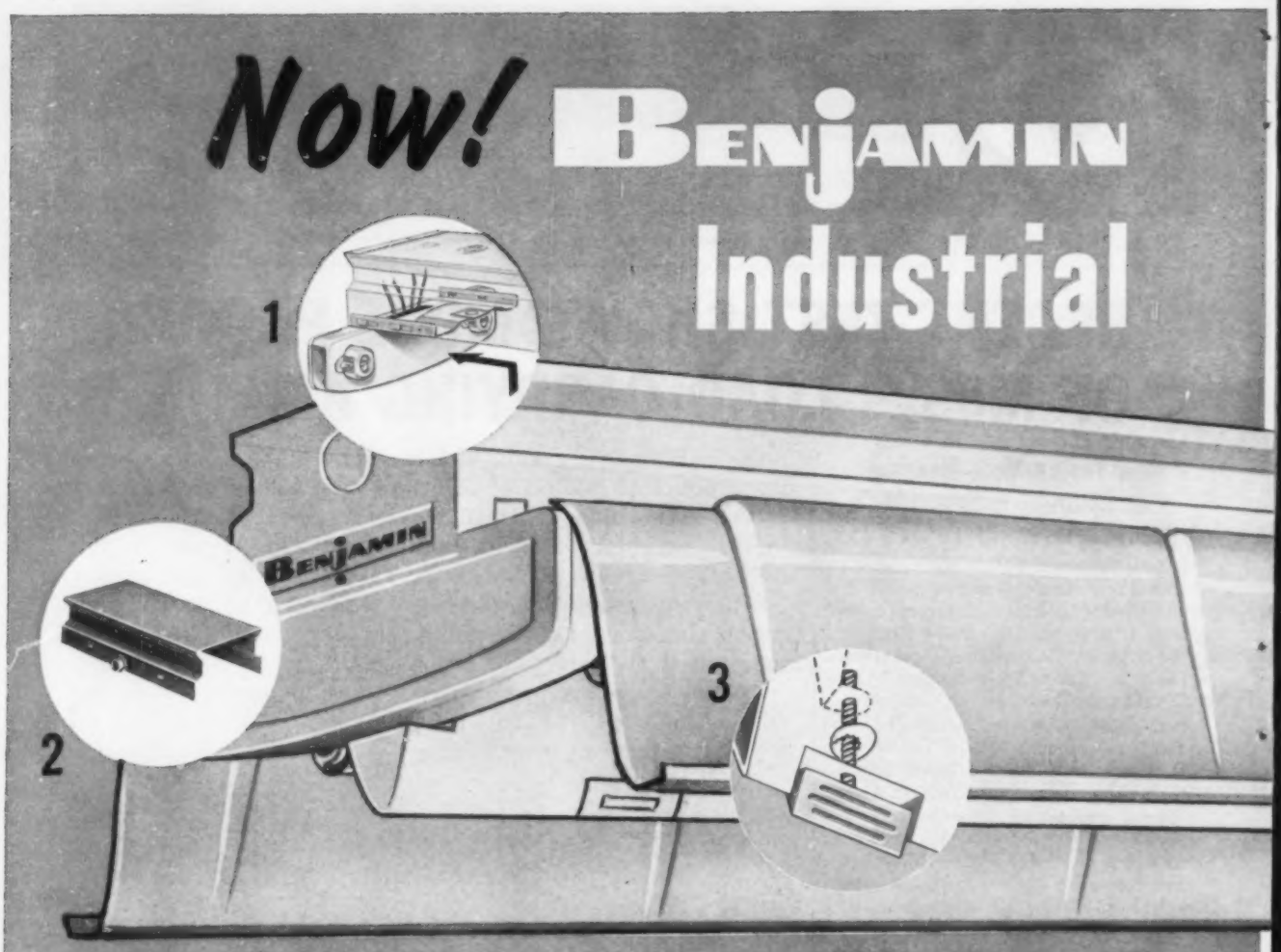


The photo above shows mild steel pins used in Almen Wieland test. No. 1 is unused Control Pin. No. 2 (lubricated with mineral oil and MoS_2) and No. 3 (with MoS_2 bonded coating) were elongated and extruded without weight loss. No. 4 shows typical failure with conventional lubricant. Note that the key sheared off and that pin and block were galled and seized. Surveys of many laboratories indicate that the extrusion phenomenon exhibited by No. 2 and No. 3 pins has never been produced with any other conventional lubricant.

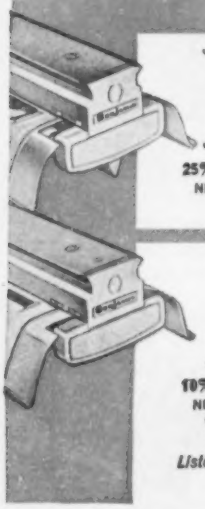
As a result of Molysulfide's unique pressure-sustaining ability, MoS_2 is widely used as a "break-in" lubricant which prevents abrasion and seizing, permits shorter "break-in" runs, and prevents bearing damage when boundary lubrication occurs.

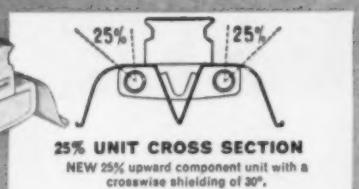
When writing, refer to CL-107

Now! Benjamin Industrial

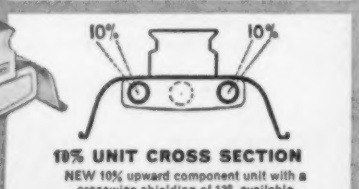


NEVER BEFORE SO MANY OUTSTANDING





25% UNIT CROSS SECTION
NEW 25% upward component unit with a crosswise shielding of 30°.



10% UNIT CROSS SECTION
NEW 10% upward component unit with a crosswise shielding of 13°, available in two and three-lamp construction.

Listed by Underwriters' Laboratories

Yes, here is industrial lighting that lifts light levels to new highs. The answer to demands for more and better lighting from each fixture, without added cost. *Now, Benjamin has custom-engineered an entire line to meet the varied requirements of modern industry.* Only Benjamin could bring you RLM quality at such a truly economical price.

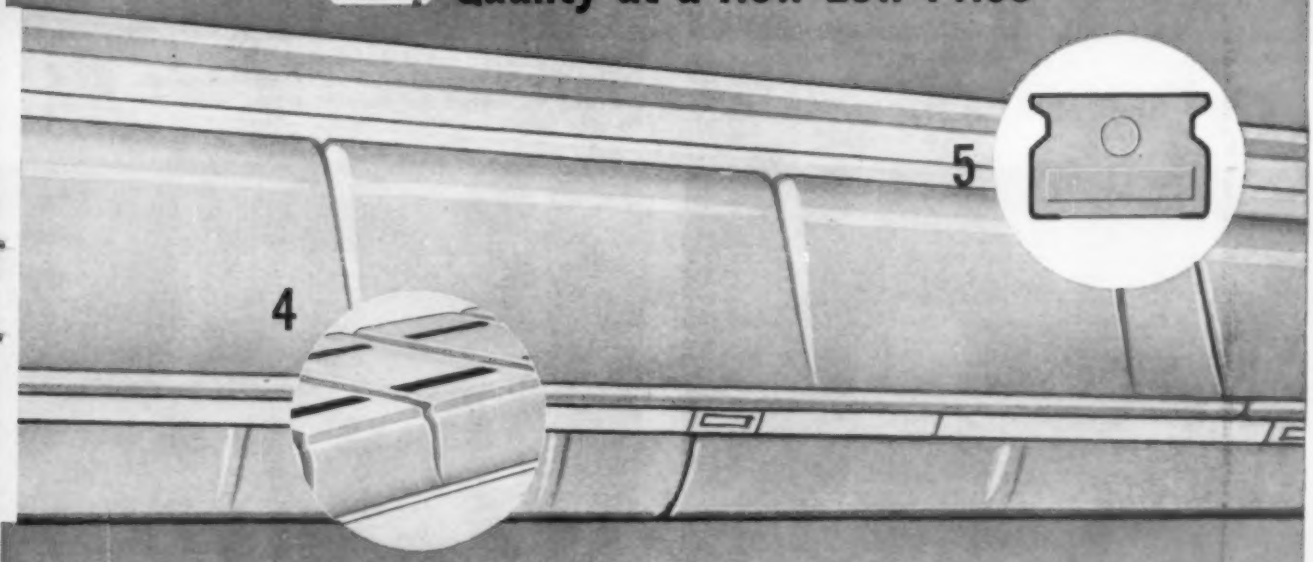
Examine the complete Benjamin lines of • **POWER GROOVE** • **SHO-VHO units** • **SLIMLINE** • **40-WATT and 800 ma. RAPID-START UNITS.** See how Benjamin gives you *extra value* for your lighting dollar. Call your Benjamin representative today to plan the correct custom-engineered fixtures for your use.

NEW PROTECTED FLUORESCENT UNITS *available with completely corrosion-resistant monel metal lampholders, porcelain frames, stainless steel spring clips, in addition to the famous Benjamin one-piece housing.*

BREAKS THE LIGHT BARRIER IN

Fluorescent Lighting

RLM Quality at a New Low Price



FEATURES

1 *New* **SNAPLOX LAMPHOLDER**
Snaps into wiring channel and locks in position, assuring rigid, trouble-free mounting.

2 *New* **CONCEALED COUPLER**
Slides inside wiring channel, allowing units to butt snugly together for easier continuous row installation.

3 *New* **TWIST-LOCK THUMB LATCH**
Simplified thumb latch offers new ease in reflector installation.

4 *New* **DOUBLE EMBOSSED REFLECTORS**
Extra rigidity is added by vertical embossed ribs and horizontal ridges. Gives extra strength and assures rattle free installation.

5 *New* **EXTRA STRENGTH WIRING CHANNEL**
Reinforced ribs insure rigidity, serve as a holding element for all Benjamin sliding hanger suspensions.

Write for Bulletin F — new 20-page technical and specification bulletin on Benjamin Industrial Fluorescent lighting. Address Benjamin Division, Thomas Industries Inc., 207 E. Broadway, Louisville 2, Ky., Dept. BPE-7.

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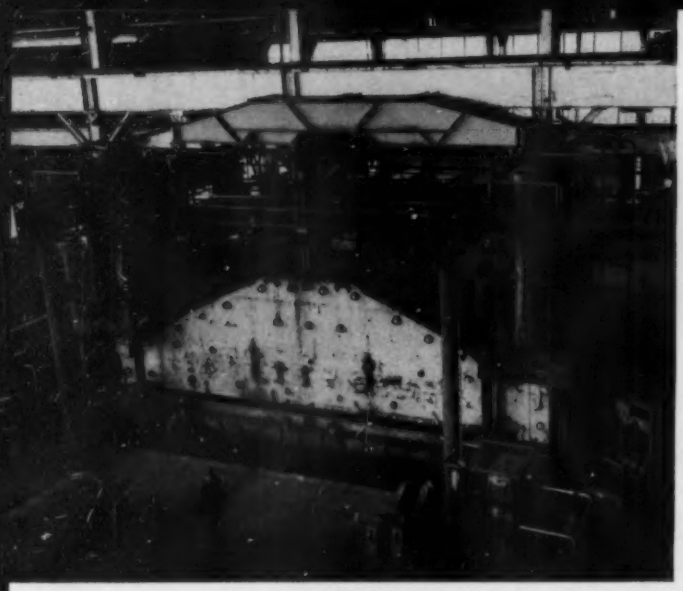
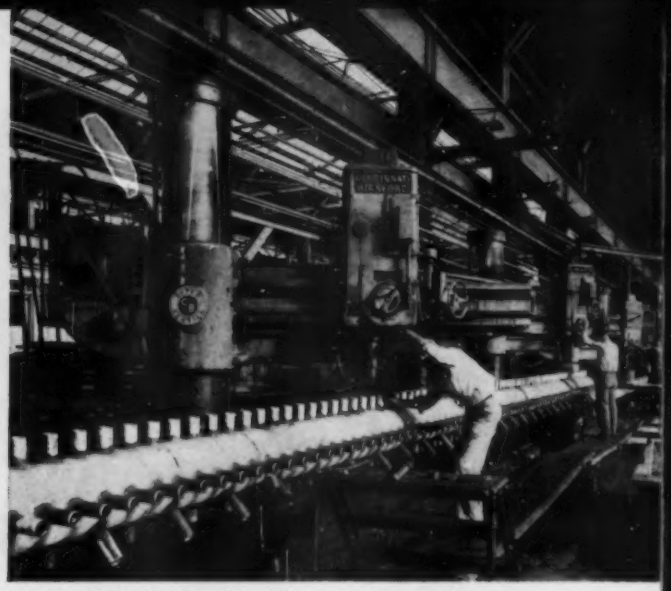
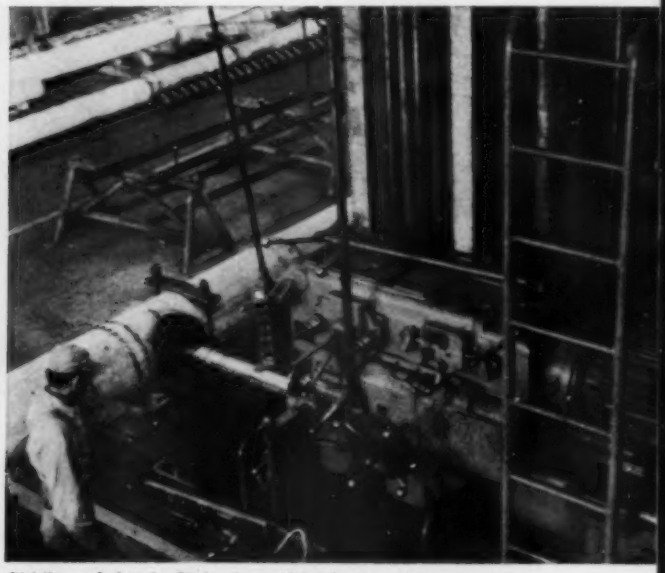


Overhead view of 2500-ton press. It forms heavy steel plate for drum shells—up to 7 inches thick, up to 30 feet long. Gulf Harmony 61 is used in the hydraulic system.



Cincinnati Bickford radial drill presses — working on headers. Gulf Harmony 61 is used in column mechanism, drill-head mechanism and main drive gear boxes. Gulf Precision Grease is applied to fittings.

Colburn Vertical Boring Mill—milling a drum head. Gulf Harmony 61 is used in the circulating system for main drive gears; in the reservoir for feed change gears.



Giddings & Lewis 6" horizontal boring machine—boring hole in header. Gulf Harmony lubricates the column slides and screws on this new machine.

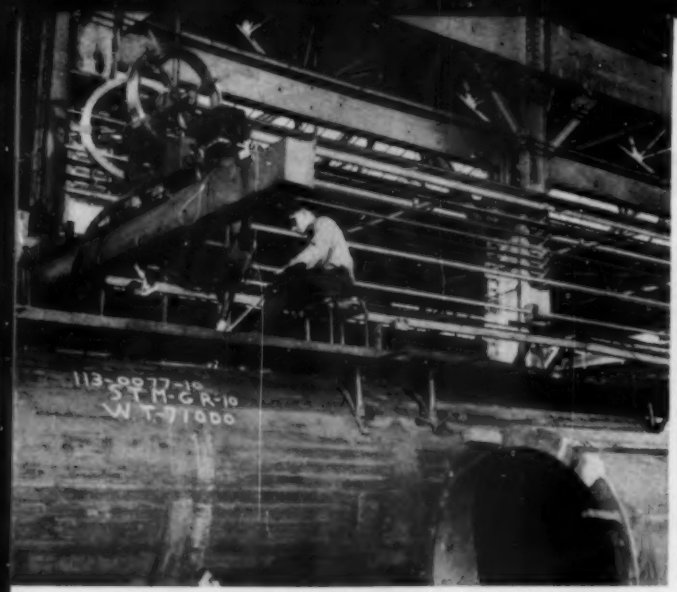
Simplified lube program helps Babcock 16 lubricants to just 7...

The Paris, Texas, plant of Babcock & Wilcox specializes in the manufacture of steam generating equipment. Typical examples: 65-ton boiler drums and 4-ton tube sections.

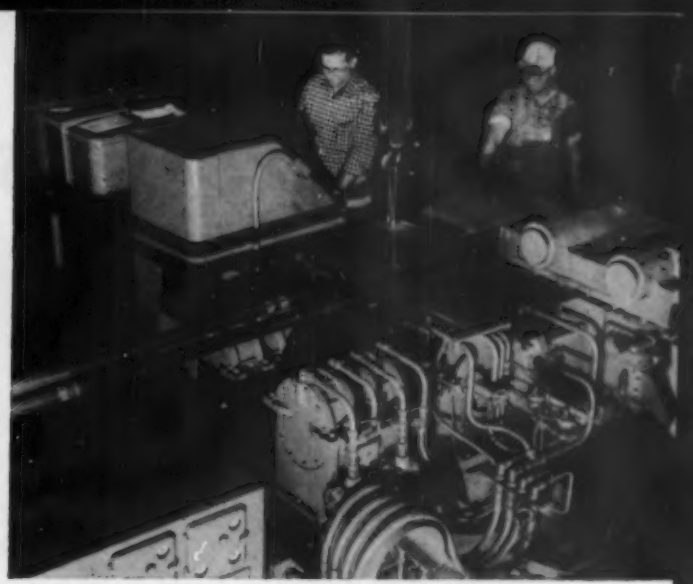
Recently, Gulf Sales Engineers conducted a lubricant survey in this plant. As a result, lubes were reduced from 16 to 7. This reduced the possibility of application errors and simplified ordering, bookkeeping and handling.

"It's important to keep lube recommendations up to date," says C. C. Eagon, Master Mechanic. "We call in lubrication engineers as new machines arrive. And they help us translate the manufacturer's lube recommendations in terms of their oils and greases."

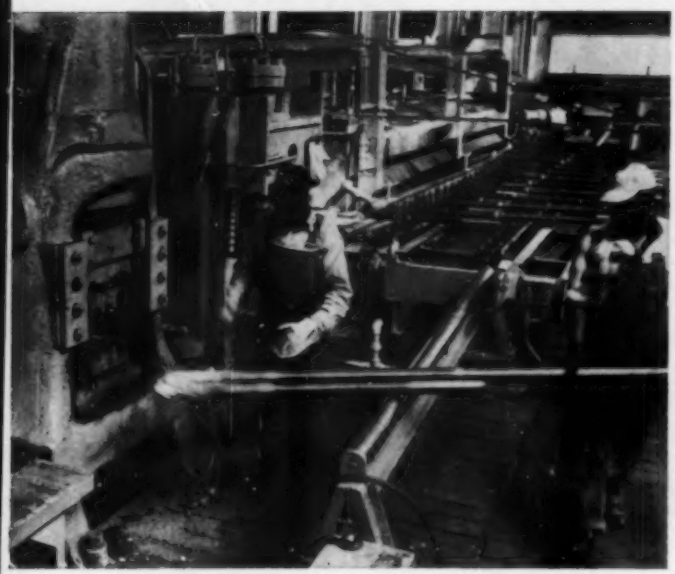
The seven recommended grades are really four basic types of Gulf oils and greases. First, Gulf Harmony® oils—highly stable lubricating oils with excellent water separating properties; inhibited against



Automatic submerged arc welder is used to weld drum halves together, Gulf Precision Grease and Gulf E.P. Lubricant 95 protect bearings and gears of this machine against excessive wear.



Tubes joined together in butt-welder. The hydraulic system reservoir is filled with Gulf Harmony 44. Gulf Harmony 61 is used in milling machine gear box. Gulf Precision Grease lubricates guide shaft bearings.



Sizing press. Turbine is sized in this press after it goes through swedging, upsetting and bending operations. Ways and shaft bearings are lubricated with Gulf Precision Grease, from central greasing system.

Works Manager R. L. Reed (left) talks with Frank P. Mauro, Gulf Sales Engineer. The drums behind them are being shipped to a new power plant in Santos, Brazil.

& Wilcox reduce
GULF MAKES THINGS RUN BETTER!

rust and corrosion. Next, Gulf E.P. Lubricants—used where shock loads and high pressures are factors. These superb lubricants are non-foaming, noncorrosive and extremely stable. Thirdly, Gulf Lubcote®—tough and tenacious. It protects against wear. And it cushions the sliding and rolling of gear teeth. Lastly, Gulf Precision Grease—a general purpose ball and roller bearing grease to satisfy the plant's grease-lubrication demands.

Simplify your lube inventory with versatile Gulf multipurpose lubricants. And see for yourself how Gulf makes things run better! Just call a Gulf Sales Engineer at your nearest Gulf office. Or write for information.

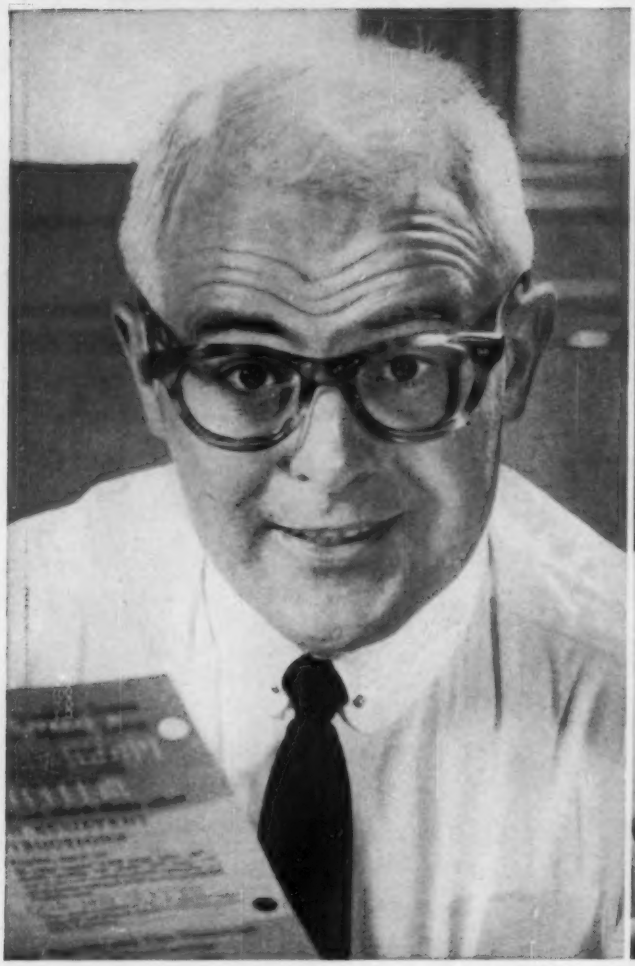
GULF OIL CORPORATION
Dept. DM, Gulf Building
Houston 2, Texas

GULF®

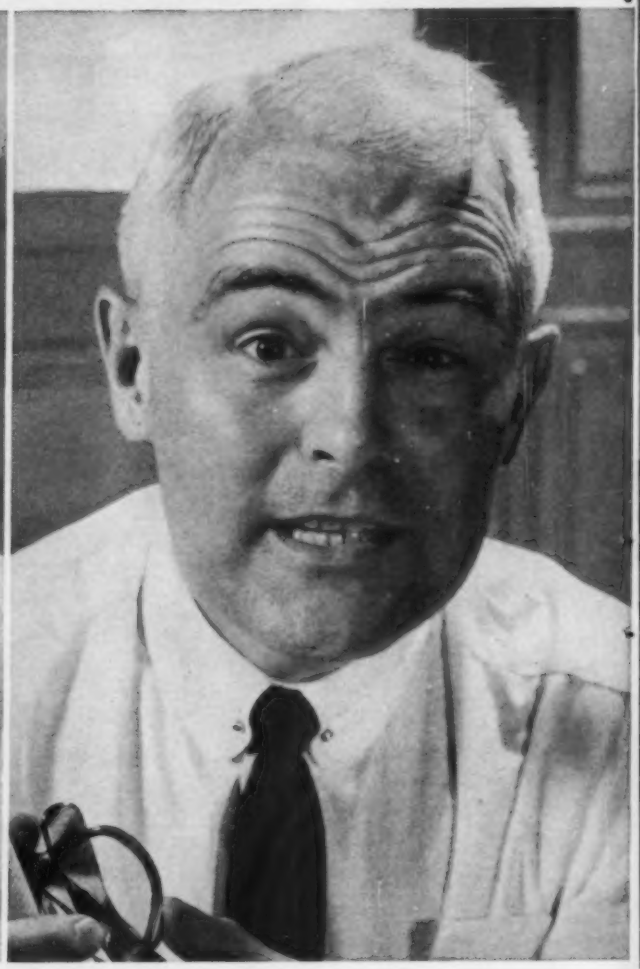
Circle 507 on postcard, page 33

GOODYEAR

Hose? Goodyear



THE KIND I NEED?
(No matter how tough or unusual your application or what type hose it calls for—*Goodyear has the answer!)*

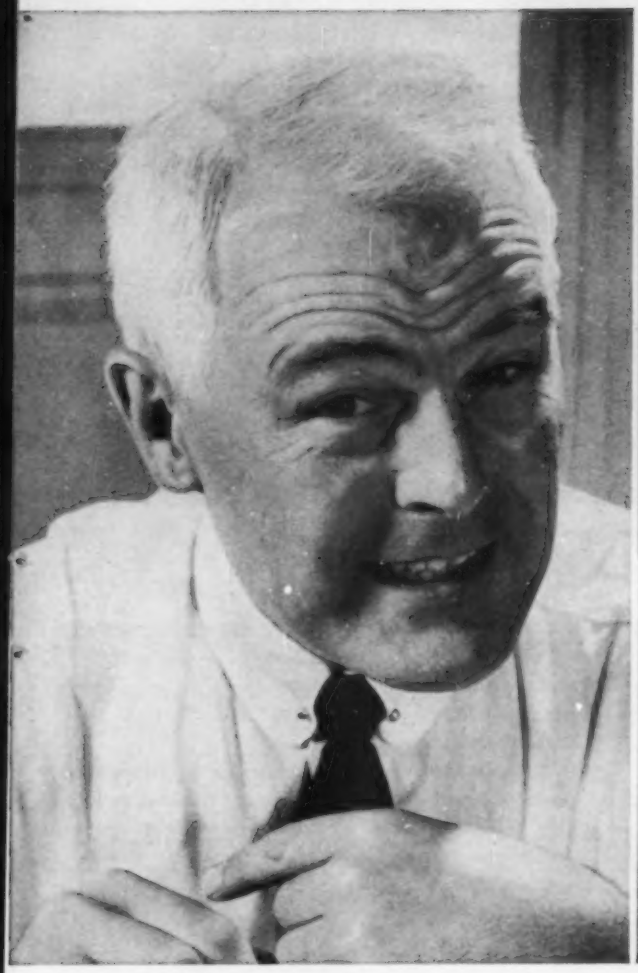


WHEN I NEED IT?
(When you need hose in a hurry—locally available right from distributor stocks—*Goodyear has the answer!)*

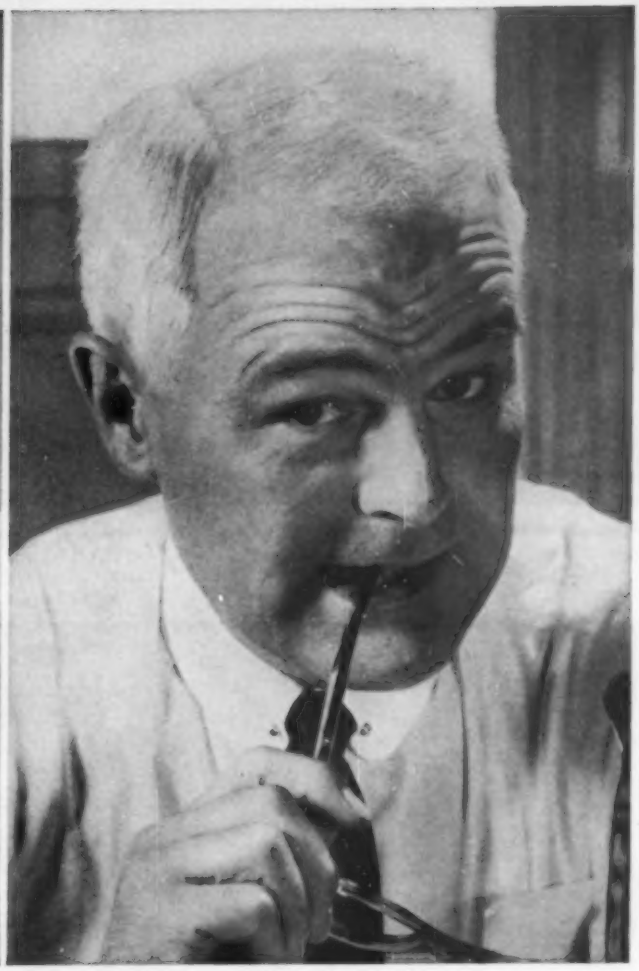
FOR THE RIGHT HOSE... AT THE RIGHT PLACE...
CALL YOUR GOODYEAR DISTRIBUTOR... first in

Lots of good things come from GOOD

Has All the Right Answers!



TOUGH AS I NEED IT?
(For the extra ruggedness, extra dependability and extra safety of real quality hose—*Goodyear has the answer!)*



SPECIAL HELP WHEN I NEED IT?
(Call for the advice of an expert like the G.T.M. – Goodyear Technical Man – and *Goodyear has the answer!)*

AT THE RIGHT TIME... AT THE RIGHT PRICE...
service with all industrial rubber products

Or write Goodyear, Industrial Products Division, Akron 16, Ohio

GOODYEAR INDUSTRIAL PRODUCTS

Circle 508 on postcard, page 33

Westinghouse helps assure Texas Instruments constant power supply

Handsome exterior is showcased at night by 60 AH 16 floodlights, ideal for decorative lighting applications.

Viewing future expansion areas in TI's 300-acre Dallas site are, left to right: A. P. Hammerstrom, Division Manager, WESCO; L. P. L'Hommedieu, TI's Senior Maintenance Engineer; H. R. Hill, Westinghouse Area Manager; G. K. Jones, Westinghouse Engineer; C. L. Surface, Engineer, Harmon Electrical Construction Co.

More than 50 Westinghouse DT-3 type transformers are located in space frames formed by concrete V-tetrapods separating upper and lower levels. This 80 KVA unit transforms 480 volts to 120/208 volts at the point of utilization. Smaller sizes of DT-3 transformers enable convenient placement even in this cramped location. These vibrationless units are inaudible in engineering spaces below, and their high dependability has resulted in maintenance-free operation for Texas Instruments.

A plant that expresses the attitudes and capacities of its people . . . a power system that must carefully feed electronic miracles . . . these are two important physical parts of the new Texas Instruments, Incorporated, operation at Dallas, Texas.

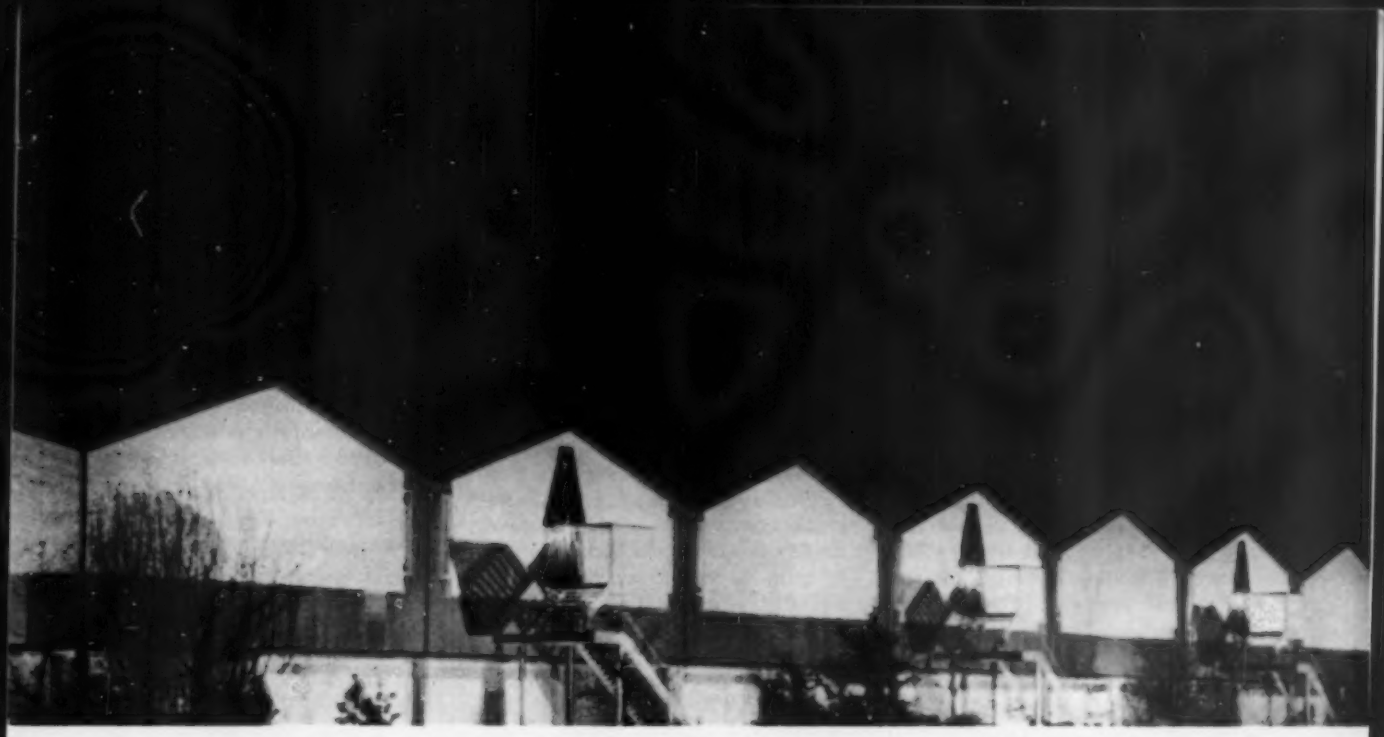
Behind a striking modern appearance is an intricate complex of engineers and equipment responsible for over 5,000 types of electronic components—from germanium transistors and silicon transistors, diodes, and rectifiers to infrared detecting cells, tantalum capacitors, and precision resistors.

TI's 24-hour manufacturing operation is dependent on a constant, well-controlled power supply. Key elements in this plant's primary selective radial distribution system are four Westinghouse 1000 KVA power centers, each equipped with two primary switches connected to separate feeders. In case of feeder fault—primaries can be switched to restore service. Power centers are quiet enough in operation to permit placement in first floor area adjacent to engineering offices.

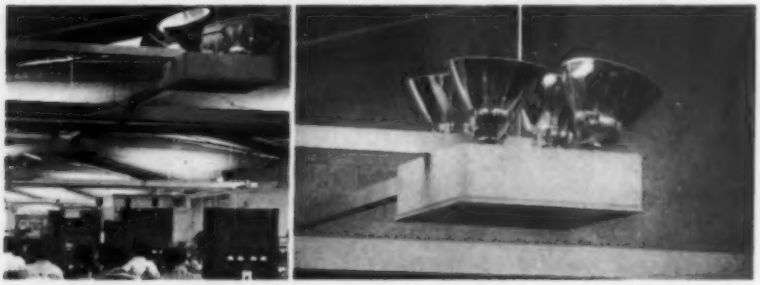
Other Westinghouse products selected from the industry's broadest line of electrical-mechanical equipment include dry type transformers, indoor and outdoor floodlighting, motors and control. Application problems were given full attention by Westinghouse sales engineers, working with the contractor and consulting engineer. The completeness of service and product line is available to you for any new construction or planned modernization. You can be sure . . . if it's Westinghouse.

Westinghouse

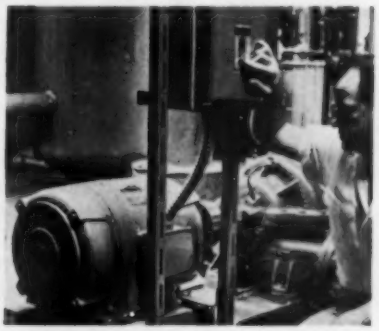
J-94162-1



Owner: Texas Instruments, Incorporated
Architects & Engineers: O'Neil Ford & Richard S. Colley, Corpus Christi and Dallas, Texas
Electrical Contractor: Harmon Electrical Construction Co., Dallas, Texas
Electrical Distributor: Westinghouse Electric Supply Co., Dallas, Texas



More than 1000 Westinghouse ARC 20 floodlights mounted in clusters throughout the plant combine to produce a soft, glarefree, diffused light with a uniform intensity of 64 ft.c. Reason for unique lighting arrangement is a hyperbolic paraboloid roof—designed to carry little weight and with an infinite surface variation making conventional rows of fixtures impractical. Lightweight ARC 20 units are made from spun aluminum offering a high degree of reflection. Lamps are Westinghouse AH-15 mercury vapor, many of which, in original installation, are still operating after more than 23,700 hours continuous duty.



Maintenance-free operation is important on this remotely controlled hot water pump drive. Sealed, prelubricated bearings plus superior insulation give this 30 hp Life Line A drip proof motor reliability without constant attention. Control is a size 3 Class 11-200 Magnetic Lifeline starter which provides motor running protection through bi-metallic type Thermal overload relays. Long contact life is assured through use of de-ion® arc extinction—which splits, stretches and extinguishes an arc faster, with less contact temperature rise than any known system.

L. P. L'Hommedieu, A. P. Hammerstrom and C. L. Surface inspect one of four Westinghouse 1000 KVA ventilated dry type power centers. Each power center consists of two primary fused type LCB switches, 1000 KVA dry type transformers and low voltage switchgear, containing four DB 25 air circuit breakers. Heavy duty Westinghouse DB breakers offer drawout feature for easy inspection and maintenance—provide positive protection necessary in industrial power circuits.

J-94162-2

Circle 509 on postcard, page 33

HELPFUL WATER CONDITIONING DATA FROM BETZ

SLIME CONTROL WITH CHLORINE

Judicious use of chlorine and the supplemental use of other biocides will extend cooling tower life

A RECENT SURVEY of open recirculating cooling water systems has revealed that more than ninety percent of these systems require treatment for prevention of biological fouling in order to avoid loss in heat transfer and to prevent accelerated corrosion. The survey further revealed that in the majority of these systems chlorine is used for slime control or is supplemented by a non-oxidizing type biocide. Chlorine is used widely because it is effective, fast acting and economical. The increased trend toward the supplemental use of non-oxidizing biocides is due to the adverse effects chlorine has on cooling tower wood.

Chlorination

There is ample evidence that chemical attack renders the wood more susceptible to biological attack. It has been definitely established that excessive chlorination will cause delignification of cooling tower wood. Delignification also occurs when excessive alkalinity is maintained in the circulating water. The combination of excessive alkalinity and chlorine will produce severe chemical attack. Both chemical and biological attack have been more prevalent in towers that use chlorine alone for prevention of slime. Conversely, the incidence and frequency of chemical and biological attack has been at a minimum in systems that use non-oxidizing biocides alone for slime control.

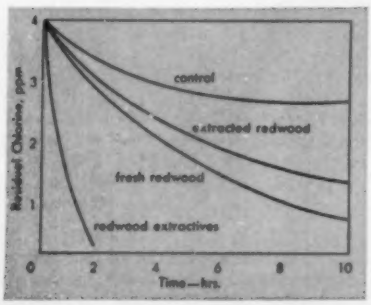


Figure 1—Reaction rate of chlorine with redwood and redwood extractives.

It may seem contradictory that an effective slime control agent such as chlorine pre-disposes wood to biological attack. Figure 1 shows the rate of reaction of chlorine with redwood and redwood extractives. In addition to reacting with the lignin components of the wood, chlorine will react with the natural extractives. The rapid removal or destruction of nature's toxicants from the wood renders the wood more susceptible to biological attack.

Undoubtedly, many of the systems that have shown rapid or excessive attack from the use of chlorine have lacked adequate control of chlorination. In many of these cases, the chlorine residual has been improperly determined, determined at the wrong point for proper control, not checked frequently enough or neglected entirely. In the majority of the systems using chlorine for slime control, the chlorine residual is checked (as it should be) in the water returning to the tower *not after the water cascades through the tower*. The water in passing through the tower will have its chlorine residual decreased to very low values or depleted entirely. The reduction in chlorine residual occurs partially due to aeration but mainly through reaction with the wood. Where attempts have been made to control chlorine residuals after the water has passed through the tower, excessive chlorine residuals have been permitted to contact the wood and accelerated chemical attack has been the result.

In instances where intermittent chlorination has been practiced, initially the duration of the chlorination period and the rate of chlorination may have been established properly by testing for the chlorine residual. However, all too often, after initially establishing the rate and duration, infrequent or no further testing for chlorine residual is made. Since the chlorine demand of most circulating waters will vary, this practice has led alternately to low residuals and poor slime control or to high residuals and excessive attack of the wood.

While the adverse effects of chlorine on cooling tower wood have been established, it has been apparent that chlorination can be used judiciously and effectively, particularly if supplemented by non-oxidizing type biocide. The chemical attack of cooling tower wood can be held to a minimum by avoiding chlorine residuals greater than 1.0 ppm and preferably by controlling residuals in the range of 0.3 to 0.5 ppm. The pH of the circulating water has an important bearing. Where chlorination is practiced, it is essential that a pH greater than 8.0 be avoided and preferably the pH be maintained in a range of 6.0-7.0.

Non-oxidizing Biocides

The prevalence of biological attack of cooling tower wood in systems using chlorination has led to the conclusion that chemical attack predisposes the wood to biological attack. In cases where carefully controlled chlorination is practiced and chemical attack of the wood surfaces is low, studies have been conducted to check the incidence of fungi on the surfaces of the wood and in the subsurface sections. Microtome sections of the wood, such as that shown in Figure 2, reveal a high incidence of fungi in the wood from the fill and plenum areas of the tower. These studies indicate that chlorination alone is not effective in controlling the organisms responsible for attack of wood. The judicious use of chlorination requires low residuals be maintained. As the water cascades through the tower, these residuals are depleted. The air-borne organisms therefore can and do accumulate

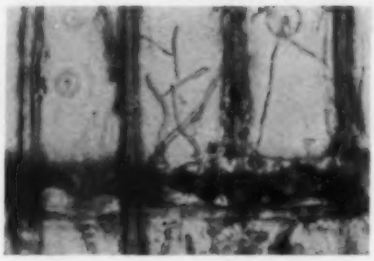


Figure 2—Fungus hyphae growing through wood cells.

readily on the surfaces of the wood and grow and develop in the subsurface sections. Similar studies conducted for systems that use non-oxidizing biocides alone for slime control show that the incidence of fungi on the wood surfaces is negligible. Since these biocides do not react with the wood, they are able to penetrate the wood surfaces and effectively control the causal organisms. Accordingly, the supplemental use of non-oxidizing biocides is necessary where chlorination is practiced to assure maximum tower life.

One other shortcoming of chlorination has been noted in systems that have large tower sumps wherein the water remains relatively stagnant. Small chlorine residuals do not carry down into the lower depths of the tower sump. Muck and debris accumulate in these areas and provide ample food for growth and development of microorganisms.

	Bacterial Counts			Fungi
Sampling Point	Total	Spore	Sulfate Reducing	—
Circulating water	5	1	0	1
tower sump	2,900,000	63	5	10
Circulating water	6	1	0	0
tower sump	5,600,000	910	2	100

(Counts—no. per ml.)

Table I

residual will be difficult. The supplemental use of non-oxidizing biocides which are not affected by these contaminants will simplify control. In cases where the chlorine demand is continuously high, the economic advantage of chlorine can disappear and the use of alone does not accomplish this purpose, the use of non-oxidizing biocides is required. The added cost for biocides should be charged partially to slime control, and partially to preventive maintenance to lower costs for tower repairs and assure longer tower life.

AND NON-OXIDIZING BIOCIDES

Chemical attack showing ridged and fibrillated wood surface.

Table I shows the microbiological populations for samples taken of the circulating water and from the lower depths of the tower sump. In addition to the high bacteria counts, sulfate-reducing bacteria and fungi were present. Where chlorination is practiced, particularly on an intermittent basis, these areas serve as a point of inoculation. The supplemental use of non-oxidizing biocides will serve to eliminate this point of infection.

In systems where the chlorine demand of the water varies widely due to organic matter present in the makeup, from periodic process contamination, or from changes in direction of the wind carrying air-borne contaminants such as hydrogen sulfide, maintaining the desired chlorine non-oxidizing biocides on a continuous basis would be justified.

Where the cooling water system is relatively small or where there is only infrequent need for slime control agents, it is convenient to employ the non-oxidizing biocides alone. These materials are available in liquid, powder or briquette form and do not require special feeding facilities. The investment for chlorine feeding equipment and the maintenance costs for such equipment would not be justified. In addition, the application of the non-oxidizing biocides does not require elaborate feeding equipment or rigid control, and the cost of application is therefore negligible.

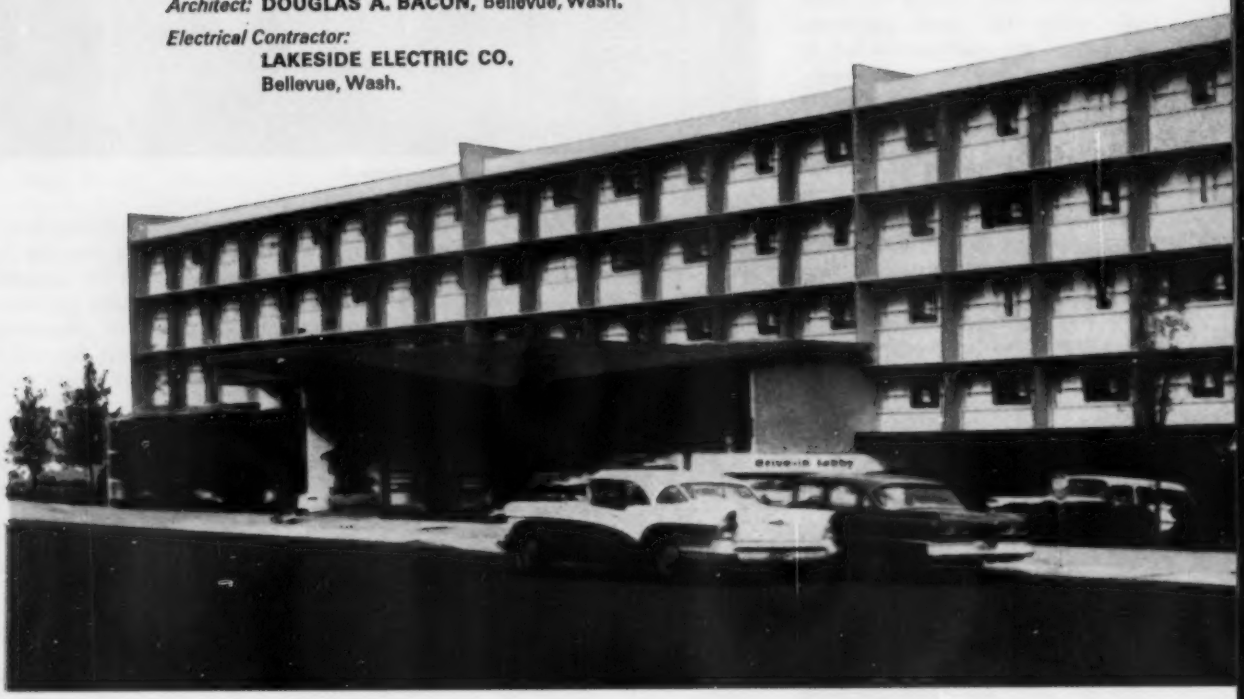
The choice of chlorine for control of slime formation in large cooling water systems is a valid one. However, the application of chlorine must be controlled carefully to avoid adverse effects on wood. It should be realized that where chlorination alone is used, the complete microbiological problem of the cooling water system is not controlled. Normally, slime control is associated with the need to assure maximum heat transfer and to minimize corrosion. *To this should be added the need to protect cooling tower wood.* Since chlorination

Biocides vary in the rapidity of their action and must be selected with a knowledge of the retention time of the system, as well as for compatibility with the corrosion control treatment and numerous other factors. Biocides must be specific for the organisms responsible for attack of cooling tower wood and must exhibit a broad spectrum of biological activity to properly control slime. Research on microbiological problems by Betz Laboratories has resulted in the development of effective and economical biocides. A study of your microbiological problem will entail no obligation. Why not contact a Betz Engineer today? Write, too, for a copy of Bulletin 605 which presents a comprehensive review on protection of cooling tower wood.

BETZ LABORATORIES, INC.
Gillingham & Worth Streets • Phila. 24, Pa.

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

Owner: **DORIC CO., Seattle, Wash.**
Architect: **DOUGLAS A. BACON, Bellevue, Wash.**
Electrical Contractor:
LAKESIDE ELECTRIC CO.
Bellevue, Wash.



Electrical Protection goes MODERN *with* BUSS Fuses...

at the Doric 6th. Avenue Motor Hotel, Seattle, Wash.

Travelers staying at this new, luxurious 175 unit motor hotel enjoy the latest conveniences of electrical living. Even the rooms are heated electrically so each person may select the room temperature he prefers.

These modern services require large electrical capacity. As a result, the available fault current is approximately 70,000 amperes.

Safe protection against faults of this magnitude is assured by the BUSS Hi-Cap fuses installed in the main entrance service. These fuses have an interrupting rating of 200,000 amperes rms. symmetrical.

To maintain safe, modern protection throughout the electrical system,—and to safeguard against unnecessary interruptions in electrical service, FUSETRON dual-element fuses are installed in the branch circuit switches.

ANOTHER BUSS HI-CAP AND FUSETRON FUSE INSTALLATION

There is a safe, modern BUSS or FUSETRON fuse with specific characteristics to match your requirements.

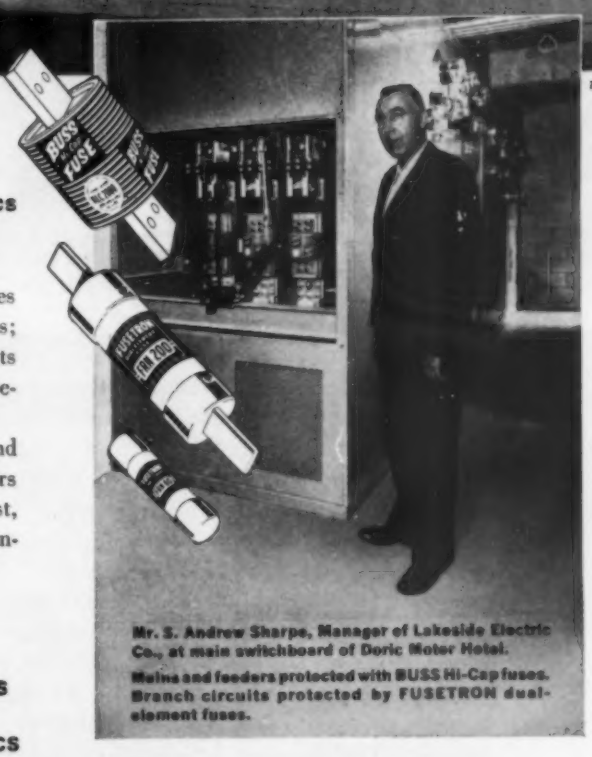
Available from BUSS: High interrupting capacity fuses to protect against fault currents up to 200,000 amperes; current-limiting fuses to restrict let-thru fault currents to safe values; long time-lag (dual-element) fuses to prevent needless outages on harmless overloads.

And with Fuses safe protection remains safe. BUSS and FUSETRON fuses are just as safe and accurate 20 years or longer after installation as on the day installed. Dust, fumes, corrosion or age cannot prevent them from opening when they should.

For more information on

FUSETRON dual-element fuses
(loads of 0 to 600 amps.) ..... **write for bulletin FIS**

BUSS Hi-Cap fuses
(loads above 600 amps.) ..... **write for bulletin HCS**



Mr. S. Andrew Sharpe, Manager of Lakeside Electric Co., at main switchboard of Doric Motor Hotel.

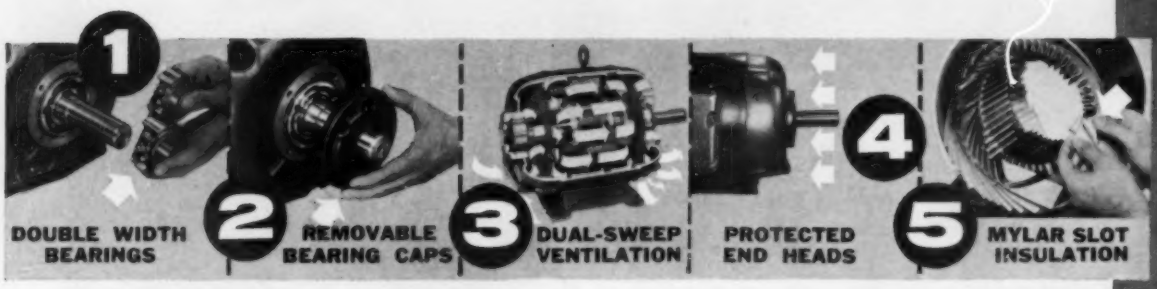
Mains and feeders protected with BUSS Hi-Cap fuses. Branch circuits protected by FUSETRON dual-element fuses.

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.* **ST. LOUIS 7, MO.**

Circle 511 on postcard, page 33

WHICH R&M MOTOR FEATURE WILL ADD MORE TO YOUR PRODUCT'S

COMPETITIVE ADVANTAGE?



All these outstanding features—*yours at no extra cost*—contribute to R&M's dependable performance, easy maintenance and long life. Fully sealed double-width bearings have extra-large reservoirs containing grease selected to resist dust, temperature, humidity and high speeds. Bearing inspection and relubrication are easy. Bearing cap on each end head comes off quickly when four bolts are removed. Bearing seal, held by removable snap rings, is also easily removed. "Dual-Sweep" ventilation greatly prolongs motor life with high-velocity cooling and cleaning. Tandem fans—one pushing, one pulling—create end-to-end ventilation that eliminates "dead" areas. Venturi baffles direct air over and around end coils. One-piece shrouded end heads give full-height protection against moisture and falling objects. Mylar* laminated to rag paper insures positive slot cell insulation because of its excellent dielectric qualities (8 times that of conventional insulation). Rag paper backing provides cushion against abrasion and puncture. Get complete information . . . write today for Bulletin 520-PE

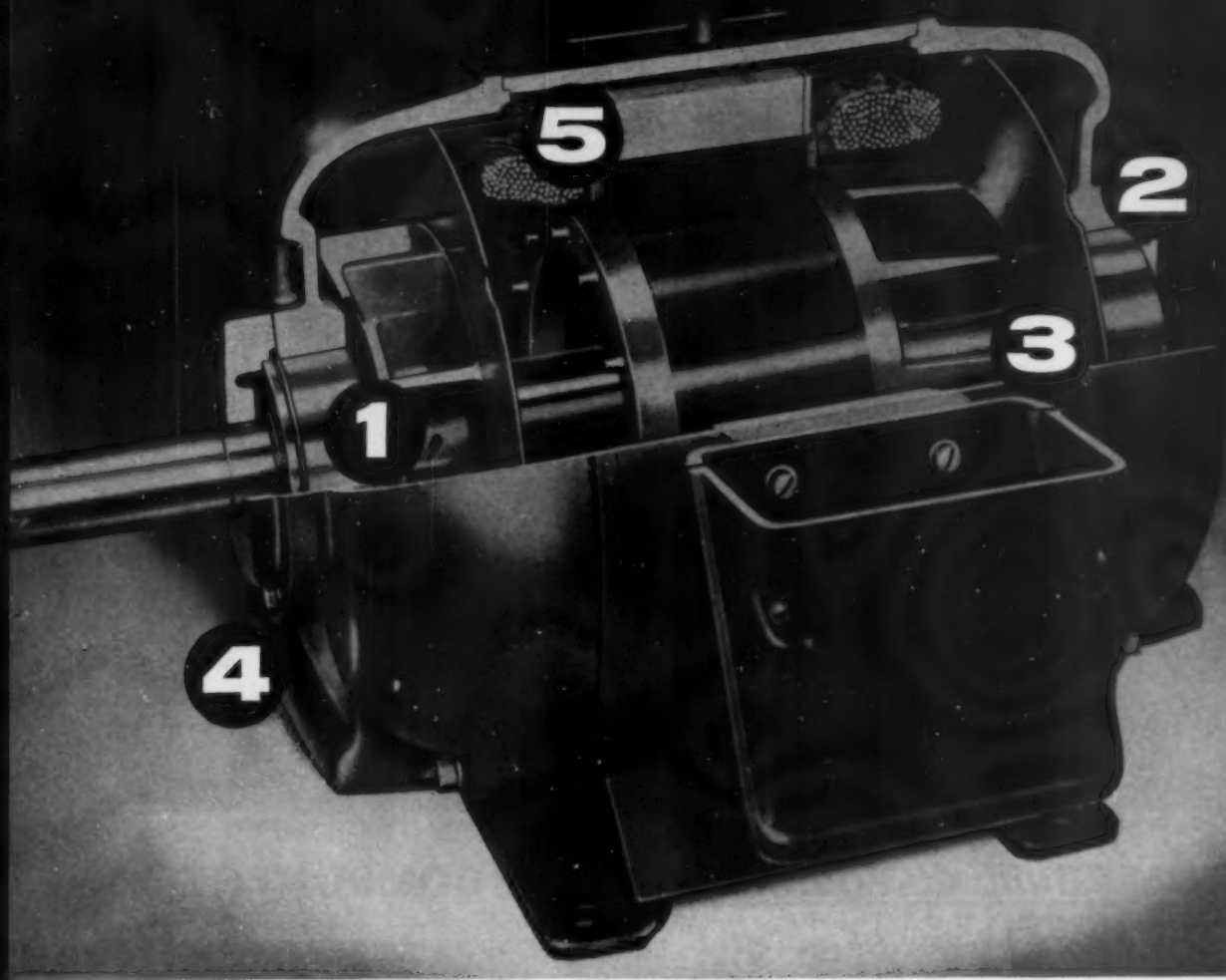
**DuPont registered trademark*

ROBBINS & MYERS, INC., Springfield, Ohio

Fractional and Integral HP Electric Motors • Electric Hoists and Overhead Traveling Cranes • Moyno® Industrial Pumps
Propellair® Industrial Fans • R & M-Hunter Fans and Electric Heat • Trade-Wind Range Hoods and Ventilators
Subsidiary companies at: Memphis, Tenn., Pico Rivera, Calif., Brantford, Ontario.

MOTORS 1 thru 200 HP

(other ratings 1/200 to 1 horsepower)

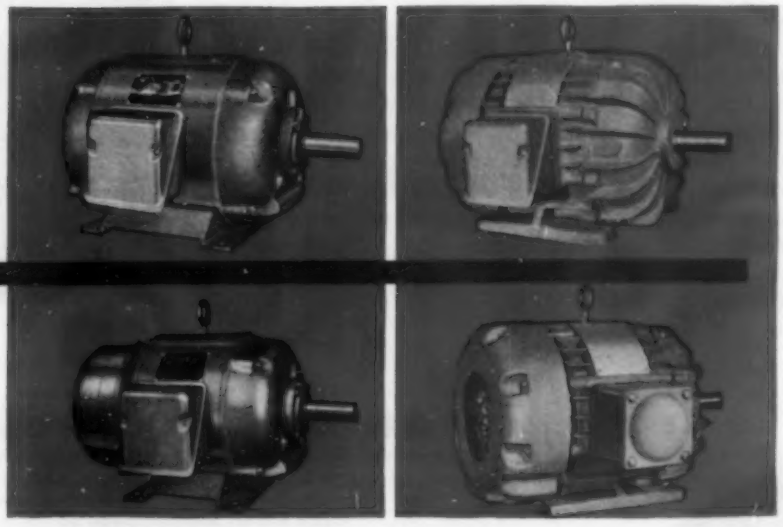


Open Protected Polyphase Motors (left), up to 200 HP, are suitable for many applications formerly requiring totally enclosed construction.

Totally Enclosed Motors (right), ½ to 200 HP, are fan-cooled . . . offer complete protection against all harmful atmospheres.

"PM" Single Phase Motors (left), ratings through 20 HP, eliminate maintenance because they are fully weatherized for severe duty.

Explosion-Proof Motors (right), ratings through 200 HP, are Underwriters' Approved for Class I, Group D, and Class II, Groups F & G.



Circle 512 on postcard, page 33

Bridge Center Drive Cross Shaft Couplings Cross Shaft Bearings Current Collectors Push Button Station End Trucks Magnetic Control

R&M *"Build-It-Yourself"* CRANE COMPONENTS

Now, save up to 30% by using R&M's new high-quality components to build your own rugged, hard-working crane in spans through 50 feet, capacities through ten tons! R&M supplies all parts, except structural steel and drive shaft (obtainable locally). Four types of end truck assemblies meet every service requirement—motor-driven or hand-geared operation, top running or underhung. Center drive assembly provides two gear reductions, motor, magnetic disc brake, choice of single or variable speed or accelerating fluid drive. Other R&M components include magnetic controls, cross shaft bearings and couplings, current collectors, push button station. Complete assembly drawings furnished. Write for Bulletin 900-5PE

take it up / *with R&M®*
hoists / *cranes*

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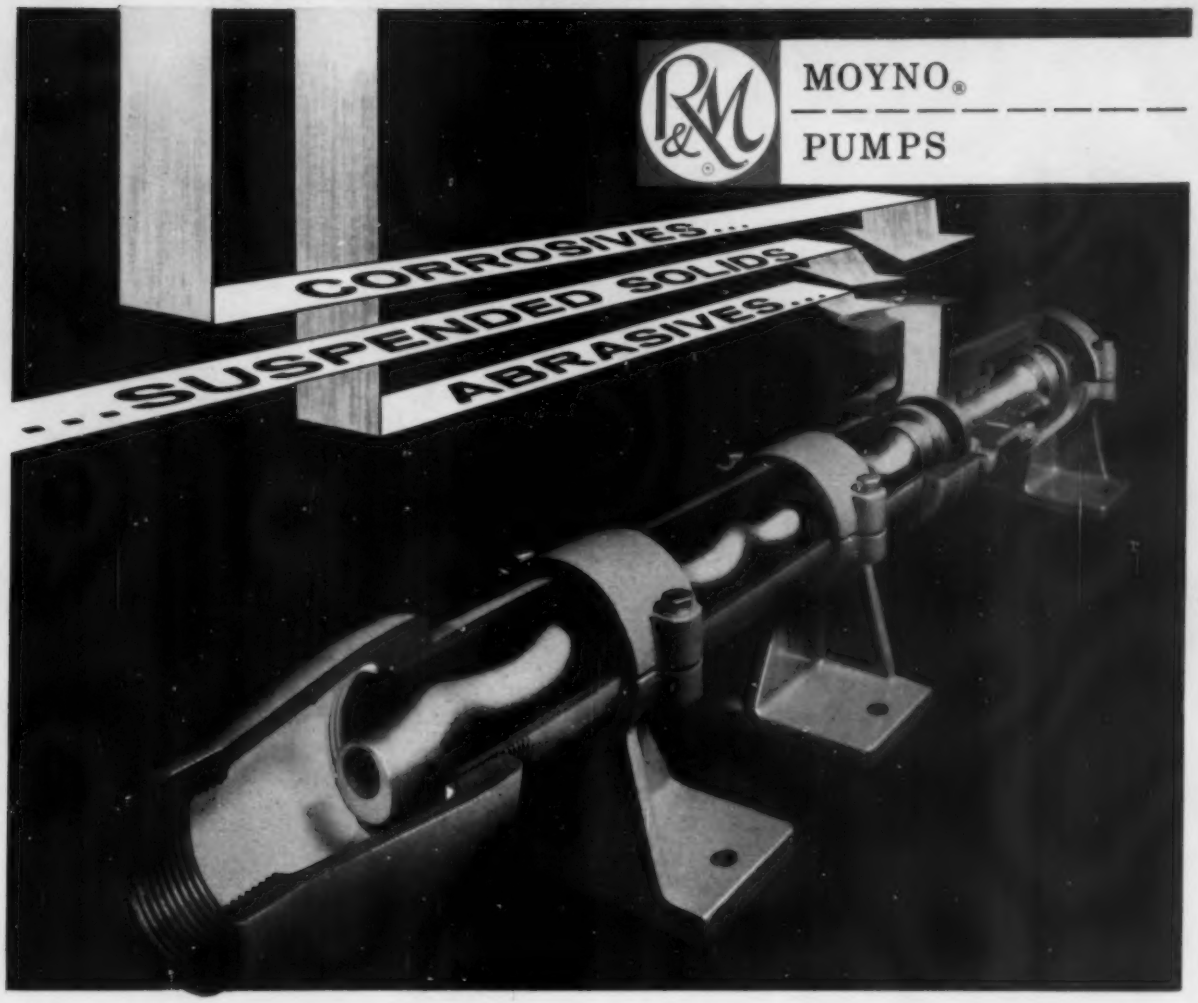
Electric Hoists and Overhead Traveling Cranes • Fractional and Integral HP Electric Motors • Moyno® Industrial Pumps
Propellair® Industrial Fans • R & M-Hunter Fans and Electric Heat • Trade-Wind Range Hoods and Ventilators
Subsidiary companies at: Memphis, Tenn., Pico Rivera, Calif., Brantford, Ontario.

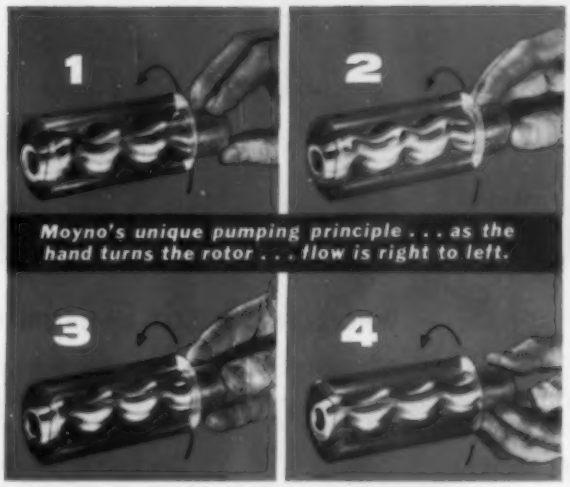
Circle 513 on postcard, page 33



MOYNO® *solves tough pumping problems!*

Moyno's "progressing cavities" successfully handle thin watery slurries, non-pourable abrasives, gnawing corrosives or suspended solids up to 1⅛" dia.—without crushing, foaming or aerating! Material contacts only one moving part, a screw-like rotor revolving in a double-threaded stator. Where corrosives or abrasives are to be handled, rotor and stator are made of special resistant materials that minimize maintenance and prolong pump life. Many materials now pumped by Moyno were once considered "unpumpable" . . . had run up prohibitive maintenance costs on other type pumps or ruined them completely!

Moyno pumps are available in capacities to 500 gpm; pressures to 1000 psi. Learn more . . . write today for new Bulletin **100-PE!**



Moyno's unique pumping principle . . . as the hand turns the rotor . . . flow is right to left.

ROBBINS & MYERS, INC., Springfield, Ohio

Fractional and Integral HP Electric Motors • Electric Hoists and Overhead Traveling Cranes • Moyno® Industrial Pumps
Propellair® Industrial Fans • R & M-Hunter Fans and Electric Heat • Trade-Wind Range Hoods and Ventilators

Subsidiary companies at: Memphis, Tenn., Pico Rivera, Calif., Brantford, Ontario.

Circle 514 on postcard, page 33

WHO ELSE BUT CUTLER-HAMMER GIVES YOU ALL THESE FEATURES?

- Quick and safe maintenance
- All front connections
- Tough baked enamel finish
- Completely safe wiring troughs
- Add options . . . no crowding
- Vertical bus silver plated
- Quick latch door fasteners
- Five padlock locations
- 100% interchangeability
- Positive off-power test position
- Modular construction

CONTROL

Now! Cutler-Hammer Unitrol in two new shallow depths!

Get more compactness, more flexibility in motor control centers plus Cutler-Hammer dependability and safety

With Unitrol, you eliminate the high cost of mounting and wiring individual starters, as well as using far less space. Unitrol gives you flexibility, too . . . easy to change starters to fit needs and expand without disturbing other starter units. The two new shallow depths (15″ and 12″) make Unitrol practical even on catwalks or tunnels. Unitrol's modular design lets you put as many as 8 Size 1 starters in a single section and still leave room for many options.

But, probably more important is the safety factor built into Unitrol—safety for the men and machines. For instance, you can *lock* each unit in maintenance position for complete safety. Look at the features at the left for some of the extra values in Unitrol.

What's new at Cutler-Hammer? You can see the new spirit and vitality in a flood of new products and product improvements. Plant capacity has been increased. We've added new engineering talent to increase efficiency. Everywhere you look, you can see that we're ready to help you meet the challenge of the years ahead. Get the inside story from the Cutler-Hammer sales office nearest you.

NEW! FREE! BOOKLET: The "Motor Control Center Handbook" gives you practical facts on selecting the proper control as well as estimating for future needs. Send for Pub. KJ-1-P274 now!

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.

CONTROL

Circle 515 on postcard, page 33

new-lube-free...

STERLING
Sealed and shielded bearings require no lubrication.
Keys are fabricated from tough elastic material to eliminate key and keyway wear.
Wear-resistant non-metallic bushings require no lubrication.
Shaft surfaces are corrosion-proof and require no lubrication.
CAUTION

...Sterling's variable speed drive never requires lubrication

Costs Reduced—One of management's biggest headaches has been the development and maintenance of proper lubrication schedules. As a consequence, lubrication problems have long been the cause of variable speed drive failures, pulley wear, sticky pulleys, shortened belt life, excessive noise, and many other equally costly problems.

High labor costs, coupled with increased maintenance needs, are major management problems.

Lubrication Eliminated—Now, Sterling has eliminated all lubrication maintenance problems. No part of a Sterling variable speed drive needs to be lubricated.

All bearings, sealed and shielded, are factory-lubricated and therefore require no lubrication. Shaft surfaces are impregnated with a special exceptionally tough and wear-resistant material which eliminates need for lubrication. The non-metallic bushings are also fabricated from a special material that is equally wear-resistant.

Special Load-Bearing Surfaces—At no time do these surfaces require any attention. Even the keys are fabricated from a tough elastic material and will not wear out.

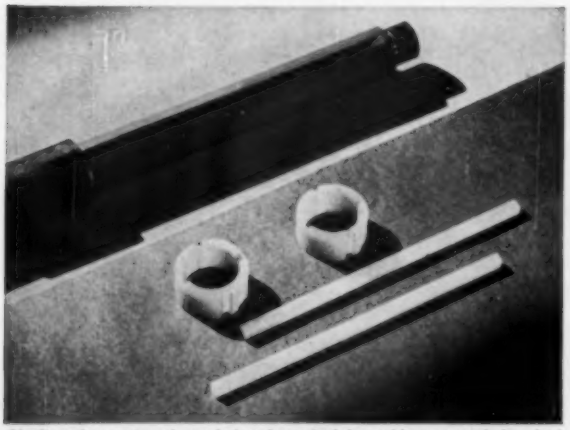
Fret corrosion, long a problem with metallic load-bearing surfaces, is completely eliminated since non-metallic surfaces now carry the load. Sticky pulleys, frequently the result of improper lubrication, are no longer a problem.

Sterling's new "Lube-Free" variable speed drive can be installed in any location, no matter how inaccessible, since lubrication maintenance is no longer needed.

Other Benefits—Costs are reduced, money saved, when lubrication maintenance is no longer necessary. Belt life is lengthened; pulley wear is eliminated. Bearing life may also be lengthened by the elimination of worn pulleys—often the cause of vibration and bearing wear.

All other Sterling variable speed advantages are present in this new "Lube-Free" drive: wide range of speeds, heavy duty cast iron case, finger-tip speed control, etc.

Information Available—Complete application and product information is available by writing Dept. D-3, Sterling Electric Motors, Inc., 5401 Telegraph Road, Los Angeles 22, California—or by contacting the Sterling field engineer in your area.



Shaft surfaces are extremely tough; material provides unusual chemical resistance and anti-frictional properties that make an excellent load-bearing material operating under extremely low or high temperatures. Keys and bushings are fabricated from a material proven to have outstanding abrasion resistance; holds up indefinitely under frictional conditions, thus eliminating need for lubrication.

This V & O Notching Press is powered by a new Sterling "Lube-Free" variable speed drive. It will never need lubrication. Similar units have been installed in the food processing industry. The elimination of lubrication is particularly important in the food processing industry where variable speed drives have such wide application, and where oil and grease create sanitation problems.

Hathaway INSTRUMENTS INC.

Sterling Electric Motors, Inc.

5401 TELEGRAPH ROAD, LOS ANGELES 22, CALIFORNIA,
A Subsidiary of HATHAWAY INSTRUMENTS, INC.

©1961 Sterling Electric Motors, Inc.

Circle 516 on postcard, page 33

CHEMPRO SQUARE-BRAIDED TEFLON* PACKINGS

Chempro Square-Braided Teflon Packings are tough, strong and chemically inert. They outlast ordinary braided packing many times over, holding together longer against even the strongest acid, alkali or organic solvent. Here are four popular Chempro Square-Braided Teflon packings:

STYLE No. 400 PACKING
Constructed of pure Chempro tape, braided square without lubrication. For highly corrosive services where a lubricant is undesirable.

STYLE No. 400-F PACKING
Resilient, square-braided packing of Chempro Teflon multi-filament yarn, without lubrication. For pump and valve applications in highly corrosive services where the packing must "give" to a certain extent.

STYLE No. 400-FI PACKING
Square-braided packing of Chempro Teflon multi-filament yarn and impregnated with Teflon suspensoid. This dense packing was developed for gas and vapor services where other lubricated packings were not acceptable.

STYLE No. 400-FL PACKING
Made by square braiding Chempro Teflon multi-filament yarn and externally lubricating with a non-hardening and non-melting lubricant. Recommended for high speed applications and highly corrosive services, from freezing to 350° F.

These Chempro Braided Teflon packings are available in all sizes in standard 1/16" increments from 1/8" to 3/4" square—in spool or coil forms. Can be cut to specific ring sizes, if desired.

Write for revised Bulletin CP-552.

*duPont trademark

CHEMICAL & POWER PRODUCTS, Inc.

7 Broadway, New York 4, N. Y.

Circle 517 on postcard, page 33

BACKTALK AND FORETHOUGHTS

Edited by Bea Berghorn

Maintenance Training Procedures

PLANT ENGINEERING

"I would appreciate receiving a reprint of the 32-page report on Maintenance in Training and Procedure as reported in the March Newsletter of the American Technical Education Association.

"I am sure 'How Abbott Laboratories Does It' involves my good friend John Rantala. John has been a great help in coordinating the training needs of the Waukegan-North Chicago areas with the training facilities offered in the public schools. We have the greatest respect for John's abilities and leadership." *Walter J. Bartz, Chief, Technical Education, Springfield, Illinois.*

■ Reprints of this helpful article are still available. We will be glad to send them to interested readers.—*Editors.*

Thirst for Knowledge

PLANT ENGINEERING:

"In Westinghouse's advertisement on page 53 of the March, 1961 issue of PLANT ENGINEERING, we noticed picture No. 11 but are unable to find any description of either the machinery in the background, the drinking fountain in the right foreground, or the charming young lady using the drinking fountain.

"If it is possible, we would appreciate receiving an 8½ by 11 in. print showing the front elevation of the young lady." *This letter was received from a reader north of the longest undefended border in the world. Inasmuch as the editors have a dread of causing either international or domestic crises, the writer, his company, and his country shall remain anonymous. The letter was however, forwarded to Westinghouse's advertising department.*

To reader north of the longest undefended border in the world: "As you can see from the accompanying carbon copy of our letter to D. W. Hopkins of Westinghouse, we are bending every effort (and probably our picks, too) to get you additional information on the unlabeled equipment in their March ad. I suspect that it may be highly secret —even though I'd bet a good sum that the Russians have something that approaches it in function."—*Editors.*

To D. W. Hopkins, Westinghouse: "Although the accompanying Thermo-

fax copy of a letter expresses interest in a biological, rather than an electrical product, you may be able to help this reader. If no photo is available, perhaps a complete list of equipment with dimensions, would be satisfactory. Voltage would appear to be quite high but with resistance losses canceling out any excitation advantages accruing from the specially-designed contour."—*Editors.*

To reader north of the longest undefended border in the world: "Under separate cover we are forwarding you an enlarged photograph of the equipment mentioned with the hopes that you, or possibly members of your staff, may make a detailed engineering analysis of the products illustrated.

"Unfortunately, much of the nameplate data is not presently available. Our photographer's assistant recorded much of this information and has since left the employ of our photographer. Upon departing he ran off with this data and for all we know, the model as well . . . lucky fellow.

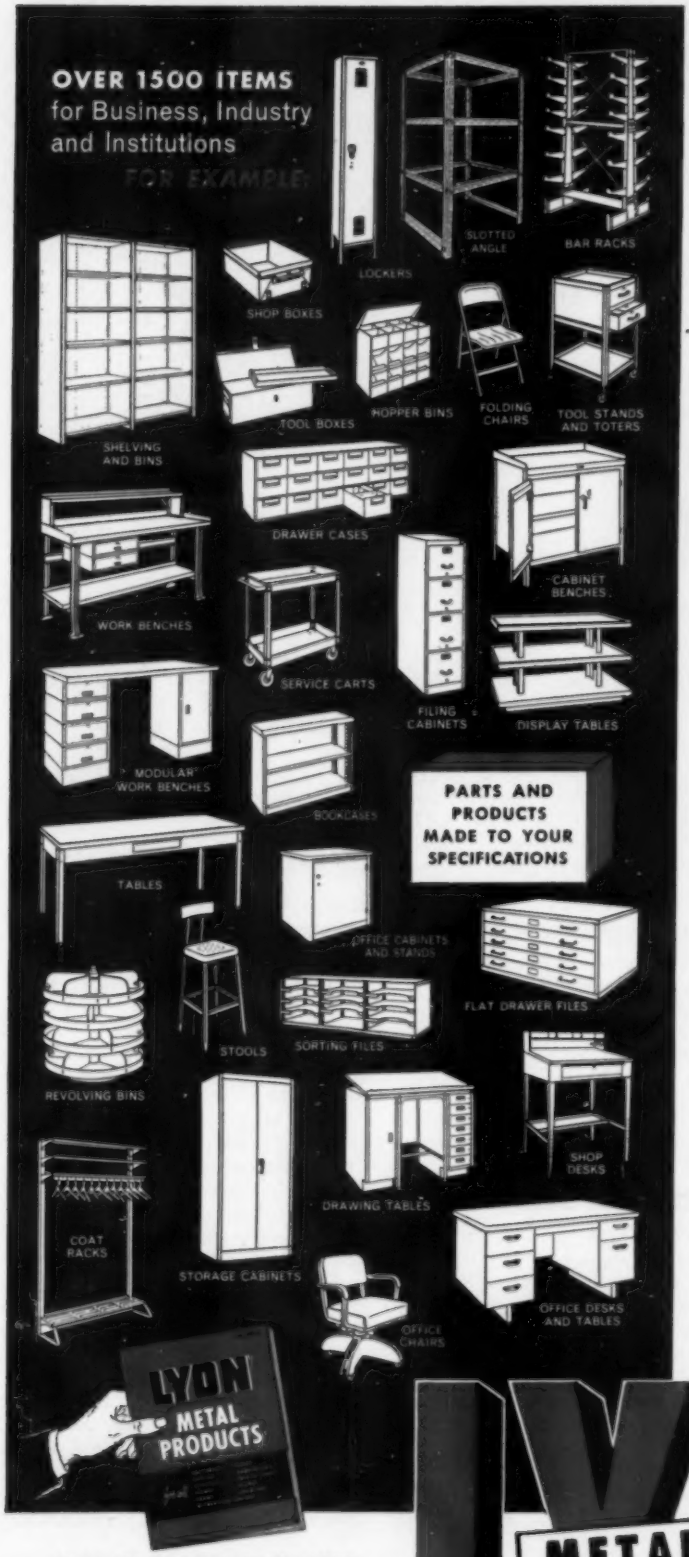
"In any event, I trust this illustration will be of some assistance to you. We appreciate your interest very much and, incidentally, you answered a question of mine by proving that people do read our ads in detail." *D. W. Hopkins, Jr., Distributor and Public Works Adv., Westinghouse Electric Corp.*

Pump Trouble Areas Qualified

PLANT ENGINEERING:

"In your June 1960 issue, you were kind enough to publish an article of mine dealing with the use of fire-resistant hydraulic fluids. From the personal inquires I have received, it seems PLANT ENGINEERING has a remarkable circulation among engineers.

"However, in response to some of the inquiries, I should like to point out that the article was a necessary



THIS CATALOG ILLUSTRATES
THE WORLD'S MOST
DIVERSIFIED LINE
OF STEEL EQUIPMENT
IT'S FREE!

LYON METAL PRODUCTS, INC.
791 Monroe Ave., Aurora, Ill.
Please send me a copy of Catalog No. 100

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Mail Coupon for your *FREE* copy...

100-PAGE BUYING GUIDE

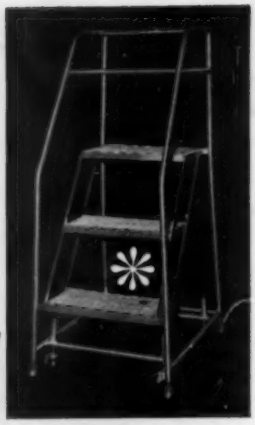
helps you get the most for your steel equipment dollars

• New 100-page catalog illustrates and describes LYON's diversified line of steel equipment . . . over 1500 items for Business, Industry and Institutions. There's a Lyon dealer as near as your telephone.

LYON METAL PRODUCTS, INC.
General Offices: 791 Monroe Ave., Aurora, Illinois
Factories in Aurora, Ill.—York, Pa.—Los Angeles
Dealers and Branches in All Principal Cities

LYON®
METAL PRODUCTS

Circle 518 on postcard, page 33



LOW C. G.

—more safety

BALLYMORE

Safety-Step

LADDERS

Just as today's cars feature a low "c.g." for on-the-road safety, so Ballymore ladders feature a low "c.g." for all-level safety. The safe, wide-base pyramid design with a low center of gravity gives a new stability even at heights up to 15 feet.

Sturdily welded, corrosion-resistant steel and aluminum Ballymore ladders are mobile and can be moved easily on casters to any area. Simple tip-toe pressure anchors the rubber tipped feet to the floor and securely positions the ladder.

WITH OR WITHOUT HANDRAILS

For illustrated catalog covering complete line, write to

BALLYMORE COMPANY, WEST CHESTER 29, PA.

BALLYMORE

EQUIPMENT FOR WORKING *Safely* ABOVE FLOOR LEVEL

Call your LOCAL DISTRIBUTOR

Circle 519 on postcard, page 33

BACKTALK— FORETHOUGHTS

digest of a much longer paper, and certain specific qualifications and explanations were not printed. In point, it should be understood that trouble areas noted to be encountered with the use of certain types of fluids were only *possible* problems, encompassing all fluids of a type and all pumps. Certainly, several reputable pump manufacturers produce pumps operating satisfactorily under conditions listed as possible "trouble areas" for a specific fluid type. As an example, the restrictions listed for "water-containing fluids" were general ones, and many exceptions exist. A prospective fluid user should by all means discuss his specific needs with his pump and fluid suppliers." *T. G. Smith, Functional Fluids Section, Product Development Dept., Celanese Chemical Co., New York, N. Y.*

Prices Gladly Given

PLANT ENGINEERING:

"During the Midwest Electrical Show last week, we stopped by your booth and were impressed with leaflets that are reprints of articles in your magazine on Troubleshooting, Instrumentality, and Servicing of Solenoids.

"We would like for you to give us a list of reprints similar to the Troubleshooting Industrial Motor Control and the others mentioned above.

"Kindly give us the price of these reprints." *J. C. Collier, Manager Chicago District, Allis-Chalmers Mfg. Co., Chicago, Ill.*

■ Information on available reprints has been sent to Mr. Collier.—*Editors.*

Selecting Motor Drives

PLANT ENGINEERING:

"I would appreciate receiving tear sheets on an article that appeared in your May issue, 'Selecting Motor Drives'. I would also like to have tear sheets on your series 'How To Plan Industrial Lighting'." *Stewart J. Walker, Plant Engineer, International Packings Corp., Bristol, N.H.*

■ These articles have been sent to Mr. Walker. We still have some tear sheets available, in case any other readers are interested.—*Editors.*

Permission Granted

PLANT ENGINEERING:

"We are much interested in securing reprints of the article entitled 'You Can Cut Motor Wiring Costs' by our Mr. Eldon G. Fox, which appeared in the March, 1961 issue of PLANT ENGINEERING.

"May we have your permission to reprint." *R. H. Turner, Advertising Specialist, Kaiser Aluminum and Chemical Corp., Oakland, Calif.*

■ We are pleased to grant permission for reprinting this article.—*Editors.*

Welding Information

PLANT ENGINEERING:

"We would appreciate it very much if you would send us six reprints of the Part I article, titled 'Training Maintenance Weldors,' by Messrs. Rantala and Jack Arzoomanian, that appeared in PLANT ENGINEERING's April issue." *M. Darkoch, Manager of Operations, L. B. Foster Co., Pittsburgh, Pa.*

PLANT ENGINEERING:

"Please send, at your earliest convenience, a reprint of the article Part I, 'Training Maintenance Weldors,' by J. W. Rantala and J. Arzoomanian, which appeared in the April issue of PLANT ENGINEERING. Please include my name on your reprint list to obtain all five parts of this interesting article, as they appear, or are available." *L. D. Scarbrough, Engineering Dept., Celanese Chemical Co., Clarkwood, Texas.*

■ Reprints are still available—no charge.—*Editors.*

Preventive Maintenance Program

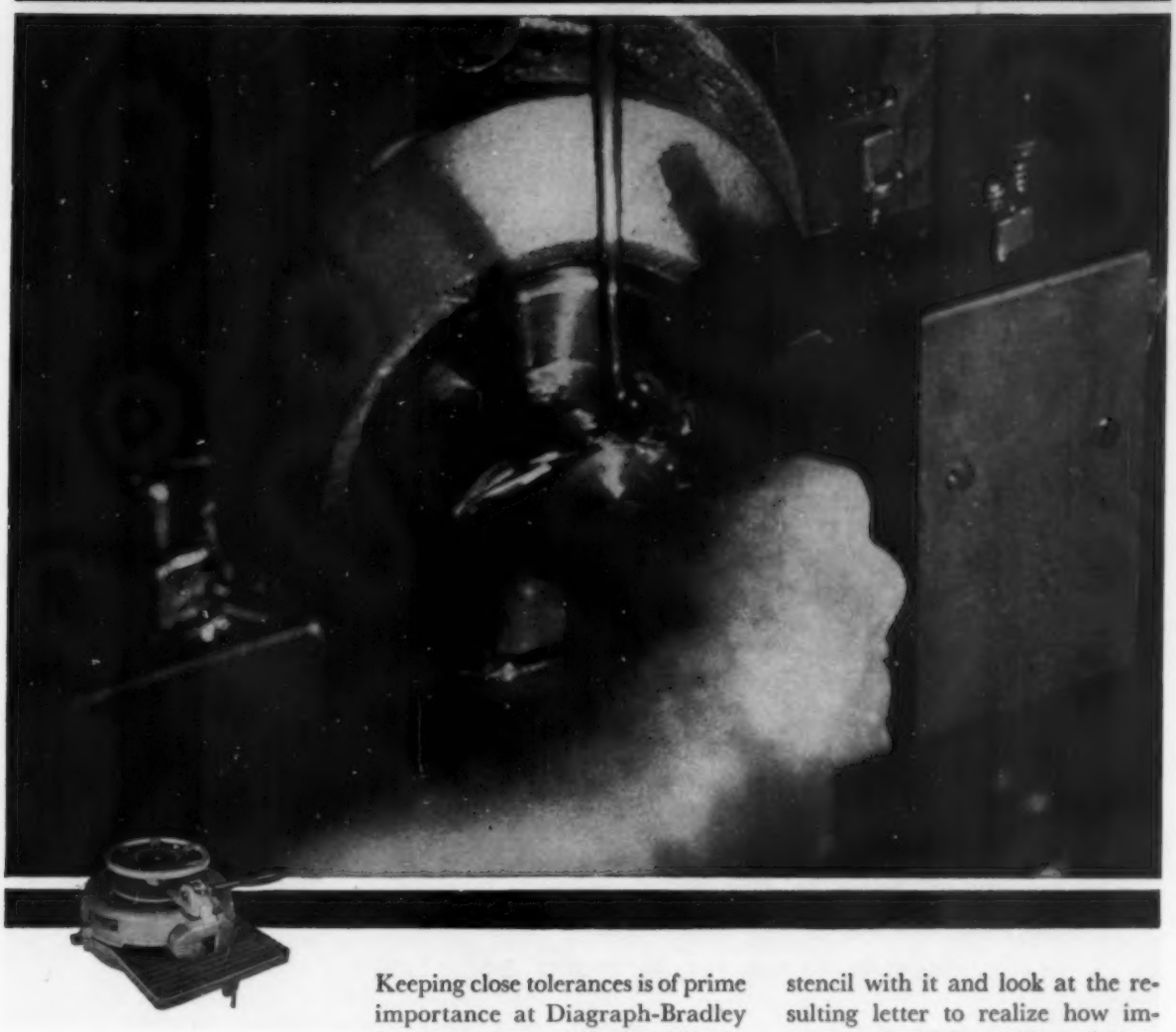
PLANT ENGINEERING:

"Would you please send me any reprints or tear sheets available on the subject of preventive maintenance.

"Our entire plant payroll is composed of about 135 people, including 19 mechanical and two electrical employees. We do not have a maintenance clerk or planner, so any program we might start would have to be very simple and straightforward as far as record keeping is concerned. We manufacture gypsum wallboard, plasters and drywall accessories. Our plant has been operating for two years and we do not have any kind of preventive maintenance program.

"If any of your people have any pertinent comments, we would appreciate receiving them as well." *D. H. Lovell, Plant Engineer, Kaiser Gypsum Co., Inc., Box 365, Antioch, Calif.*

■ We have sent Mr. Lovell several articles we believe will be of help to him. If any readers have a tried-and-true method for preventive maintenance, we feel sure Mr. Lovell would appreciate hearing from you.—*Editors.*



COOL CUTS

Keeping close tolerances is of prime importance at Diagraph-Bradley Industries, Inc., of Herrin, Illinois, leading manufacturer of stencil machines and accessories. One of the ways this is accomplished is by keeping cutting edges cool.

At Diagraph-Bradley stencil punches must be cut and held within .0005 of an inch—a fine point of precision Diagraph-Bradley attributes to the cooling and lubricating effect of Cities Service Chillo 10 cutting oil.

"You have only to take a Diagraph-Bradley machine," says one of the company officials, "cut a stencil with it and look at the resulting letter to realize how important the right cutting oil is to our production."

Cities Service Chillo 10 oil is a sulphochlorinated oil. The concentrations of sulphur and chlorine are stabilized by a special process, assuring uniformity of action through the entire cutting operation.

That's why, with Cities Service Chillo 10 cutting oil, work is always more accurate, clean and cool!

For full information call your nearest Cities Service office or write Cities Service Oil Company, Sixty Wall Tower, N.Y. 5, N.Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Circle 520 on postcard, page 33

Announcing 2 New RIDGID CONDUIT BENDERS

EXTRA-DEEP SOCKETS MINIMIZE HANDLE BREAKAGE!

Cast of high-strength malleable, these new RIDGID Conduit Benders have an exceptionally smooth, typically RIDGID quality finish you'll like on sight. Look in the extra deep sockets, and you'll see the threads down at the bottom. Elimination of strain on threads of pipe handle reduces breakage.

RIDGID Thin-Wall Conduit Benders Available in 3 Sizes

B-1677 Bends ½" Thin-Wall Conduit to 4" Inside Radius
B-1678 Bends ¾" Thin-Wall and ½" Heavy-Wall Conduit to 5" Inside Radius
B-1679 Bends 1" Thin-Wall and ¾" Heavy-Wall Conduit to 6½" Inside Radius

Exceptionally smooth side-walls hug conduit snugly . . . minimize distortion. Benders form conduit to meet National Electric Code Standards. Steadying foot pressure is easily applied on non-slip step plate. Easy-to-see arrows give accurate guide for back-to-back and stub bends.

RIDGID Hickey-Type, Heavy-Wall Conduit Benders

B-1711 Bends ½" and ¾" Heavy-Wall Conduit
B-1712 Bends ¾", 1" and 1¼" Heavy-Wall Conduit

Here's a rugged bender for heavy-wall conduit. Deep notch in lifting hook protects threaded ends. Face of bender has hardened teeth for safe, long wearing, non-slip grip.

RIDGID

Call your Distributor today. For your convenience, he maintains a complete stock of RIDGID Work-Saver Pipe Tools and parts!

THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U. S. A.

Circle 521 on postcard, page 33

BULLETINS

JUST RELEASED and OF IMMEDIATE PLANT INTEREST

LIGHTING

Fluorescent Lighting Guide

Theoretical and practical facts on fluorescent lighting and its advantages are presented in the new edition of this popular reference, 20 pp. Sections cover types of lamps and accessories, cost estimating, replacement. Sylvania Electric Products Inc.

For a copy, circle 101 on Post Card

Mercury Lamp Manual

Up-to-date technical information on initial and maintained lumen output, life ratings and essential electrical and physical characteristics of mercury lamps is in 28-pp Bulletin A-7264. Westinghouse Electric Corp.

For a copy, circle 102 on Post Card

Odds on Emergency Lighting

This 12-pp booklet shows what happens in a power failure "blackout" and how risks can be avoided. Covers probability and costs involved in power failure, gives information on Light Warden battery-operated emergency lighting. Electric Cord Co.

For a copy, circle 103 on Post Card

Fluorescent Lamp Ballasts

This 16-pp handbook covers operation and care of fluorescent ballasts with recommendations for obtaining optimum performance from a fluorescent lighting installation. Universal Mfg. Corp.

For a copy, circle 104 on Post Card

Air Diffuser for Troffer

Eight-pp Catalog CLD-70 describes a diffuser permitting coordination of air distribution and illumination in a single ceiling unit. Contains selection and preformance data. Anemostat Corp. of America.

For a copy, circle 105 on Post Card

CONSTRUCTION

Pre-Engineered Metal Buildings

Included in 6-pp Catalog BD-260 are specifications and installation details on self-supporting metal buildings for small building requirements. The Parkersburg Rig & Reel Co.

For a copy, circle 106 on Post Card

Built-Up Roofing Specifications

General requirements for built-up roofing are covered in this 28-pp 1961 manual, with roof selector guide and application information. Covers steep deck and dead level roofs, spray pond roofs, promenade tile roofs, roofing over existing roofs, insulation, and joint sealing details. The Philip Carey Mfg. Co.

For a copy, circle 107 on Post Card

Metal Framing Systems

Catalog 710 contains 36 pp of metal framing construction and maintenance facts. Covers methods of attaching to structures, surface mounted applications, types of hangers and brackets, conduit and pipe riser framing, rigid frames, cable support systems, tray supports and others. Unistrut Products Co.

For a copy, circle 108 on Post Card

Tips on Masonry Anchors

"Install It for Less," 8 pp, shows how to compare masonry anchors and methods for lowest installed cost, maximum effectiveness. Tabulated data simplifies determining right size and type. The Rawlplug Co., Inc.

For a copy, circle 109 on Post Card

Factors in Concrete Production

Six-pp Bulletin P-36c tells how to get increased strength, effective air entrainment, increased bond strength, workability, and reduced shrinkage. The Master Builders Co.

For a copy, circle 110 on Post Card

Concrete for Water, Sewage Works

Performance of Pozzolith concrete in combating weathering, freezing and thawing, saturation with water and chemical corrosion in water and sewage works is in 20-pp Bulletin MBR-P-5. The Master Builders Co.

For a copy, circle 111 on Post Card

MAINTENANCE

Industrial Maintenance Materials

Described in this 20-pp catalog are maintenance materials for floor and roof repair, machinery anchoring and grouting, and electric motor cleaning. Ranco Industrial Products Corp.

For a copy, circle 112 on Post Card

Corrosion Protection for Chimneys

Stackfas, a product resistant to acid corrosion of high sulfur fuels, is described in 6-pp Brochure SF. Stresses value in protecting new and existing chimneys, and compares it with conventional coatings in resistance to acids, heat, fly ash abrasion etc. Benjamin Foster Co.

For a copy, circle 113 on Post Card

Concrete Floor Maintenance

Methods of curing, sealing and cleaning concrete floors and of preventing dusting and blooming are detailed in 8-pp Engineered Maintenance Pamphlet 14. Puritan Chemical Co.

For a copy, cricle 114 on Post Card

Glass Reinforced Roof Coating

Advantages of Emulsi-Glass coating, consisting of spun glass mat and liquid emulsion, for restoring weathered roofs are detailed in this product bulletin. Barley-Earhart Corp.

For a copy, circle 115 on Post Card

Improved Metal Protective Paints

Catalog 61A, on use of lead-suboxide in producing rust-inhibitive coatings, explains how anti-corrosive pigment promotes film durability, provides other advantages. Subox Inc.

For a copy, circle 116 on Post Card

MATERIALS HANDLING

Gas-Powered Lift Trucks

Features and advantages of lift trucks combining gas power with electric drive are detailed in 16-pp "Facts and Factors" booklet, along with specifications. Automatic Transportation Co.

For a copy, circle 117 on Post Card

Lift N' Load, the Easy Way

Case studies showing how hydraulic power can be used to lower handling costs, increase production and reduce worker fatigue are provided in this 24-pp handbook on lifting platforms. Globe Hoist Co.

For a copy, circle 118 on Post Card

VALVES, TRAPS, PIPING

Valve Selector Guide

Sixteen-pp Catalog 10-B includes specifications on bronze, iron body and cast steel gate, globe and angle, and check valves, bar stock valves and forged steel gate valves. R-P & C Valve Div., American Chain & Cable Co., Inc.

For a copy, circle 119 on Post Card

For High-Pressure Liquids, Gases

Lubricated plug valves which utilize a ball bearing system to handle high-pressure line thrust on the plug are featured in this 16-pp bulletin, along with selection data. Walworth Co.

For a copy, circle 120 on Post Card

Postage-free cards for ordering Bulletins are on pages 33-34. You may also use the cards to order literature mentioned in the ads.

On Pressure-Temperature Ratings

This quick-reference chart (Bulletin 593) shows pressure-temperature ratings for materials used in steel valves. Edward Valves, Inc.

For a copy, circle 121 on Post Card

Steam Traps and Strainers

Catalog 400, 24 pp. provides streamlined data on thermostatic and expansion steam traps and strainers, covering function, operation, typical applications. Features a new trap sizing method and covers selection for steam service, air and liquid heating, direct and indirect steam contact heating. W. H. Nicholson and Co.

For a copy, circle 122 on Post Card

BULLETINS

(Begins on page 31)

Pipe Dimensions Charted

This chart shows OD and wall thickness for ⅛- through 42-in. pipe. Includes information from ASA Standard B36 .10 showing IPS and schedule numbers and their relationship. Midwest Piping Div., Crane Co.

For a copy, circle 123 on Post Card

Functional Pipe Hangers

Features and advantages of rust-resistant pipe hanger with spring retainer design (no welding) are detailed in Form 2594. Power Piping Div., Blaw-Knox Co.

For a copy, circle 124 on Post Card

MECHANICAL POWER TRANSMISSION

Stronger Pulleys, Hubs

Curve Crown pulleys with spun end construction are described in Bulletin 1160, also Squeeze Lock hub. Pulley load ratings, dimensions and weights, and comparison of competitive pulleys. Stephens-Adamson Mfg. Co.

For a copy, circle 126 on Post Card

Power Drive Flexible Couplings

Bulletin J-23 gives specifications and capacity data on double engagement, mill motor, single engagement, extended flexible couplings. Jones Machinery Div., Hewitt-Robins.

For a copy, circle 127 on Post Card

ELECTRICAL

Electrical Machinery Catechism

Important theoretical and practical features of common d-c and a-c motors, generators and control equipment, are presented in 48-pp Bulletin E-100 P. Profusely illustrated with pictures of electrical rotating machines and allied equipment, book covers electrical terminology and phenomena. Fairbanks, Morse & Co.

For a copy, circle 128 on Post Card

Motor Application Guide

Sixteen-pp Bulletin 010 describes single—and three-phase motors, d-c motors, gearmotors and selective speed drives. Selection charts match motor characteristics to applications. Motor characteristics are discussed, ratings included. Century Electric Co.

For a copy, circle 129 on Post Card

100-Amp Bus Duct

Eight-pp Application Data 30-666 tells how benefits of conventional bus duct — flexibility, re-use, frequent plug-in openings, etc.—can be obtained for installations where smaller blocks of power are used. Westinghouse Electric Corp.

For a copy, circle 130 on Post Card

Electrical Trolley Busway

Design and installation details on a flexible trolley busway system and crane and hoist electrification system for distributing electrical power are presented in 42-pp Bulletin 85. Includes installation photos, diagrams, specifications. Feedrail Corp.

For a copy, circle 131 on Post Card

On Low Voltage Switchgear

Twenty-pp Bulletin 3200-1A gives comprehensive information on low voltage power circuit breakers and switchboards in unit ratings from 225 to 4000 amp. Application data, ratings and specifications included. I-T-E Circuit Breaker Co.

For a copy, circle 132 on Post Card

Metal-Clad Switchgear, Enclosure

Installation of metal-clad switchgear with protected aisle is illustrated and described in 8-pp Bulletin GEA-7190. General Electric Co.

For a copy, circle 133 on Post Card

Industrial Limit Switches

Featured in 12-pp Bulletin 201 are heavy-duty and precision plug-in limit switches for a variety of applications. Mounting diagrams, contact arrangements and specifications are included. R.B. Denison Mfg. Co.

For a copy, circle 134 on Post Card

Silicon Rectifiers for Small Loads

Three basic rectifier types—general purpose, essential service, and synchronous-motor field-excitation units—are featured in 6-pp Bulletin GEA-7066. General Electric Co.

For a copy, circle 135 on Post Card

Dielectric Testing Equipment

High-voltage testing eqipment for dielectric materials and all kinds of insulated apparatus is in 12-pp Bulletin GEA-7178. General Electric Co.

For a copy, circle 136 on Post Card

WATER CONDITIONING

Economical Water Filtration

Circular and flat leaf vacuum filters, screw type feeder and compact chlorinator for filtration of industrial process water are featured in 8-pp Bulletin 1860.20-2. B-I-F industries.

For a copy, circle 137 on Post Card

PM Water Conditioning

Automatic dispensers and water conditioning chemicals for preventive maintenance are described in this 24-pp booklet. Discusses common problems, preventive maintenance for cooling towers and evaporative condensers. Stiles-Karlsonite Corp.

For a copy, circle 138 on Post Card

INSTRUMENTS, CONTROLS

Guide to Industrial Thermometers

Illustrated and described in 68-pp Catalog 100B are mercury, vapor pressure and gas actuated dial thermometers, red mercury tubing glass thermometers, and recording thermometers. Specifications and selection data included. Manning, Maxwell & Moore, Inc.

For a copy, circle 139 on Post Card

Improved Temperature Transmitter

Pneumatic temperature transmitter which uses filled thermal system and transmits a standard 3-15 signal varying in proportion to changes in thermal temperature is featured in 8-pp Specifications S 630-1. Minneapolis-Honeywell Regulator Co.

For a copy, circle 140 on Post Card

Precision Pressure Regulators

Features and advantages of pressure regulators — direct acting, reverse acting, and control valves—are detailed in 12-pp Bulletin 116. Provides flow coefficients for sizing. Manning, Maxwell & Moore, Inc.

For a copy, circle 141 on Post Card

Gages with Lasting Accuracy

Catalog DH-54, 32 pp presents pressure, vacuum and compound indicating gages incorporating gearless Helicoid movement. Illustrates construction features, operation. Also shows various types of cases and dials. Helicoid Gage Div., American Chain & Cable Co., Inc.

For a copy, circle 142 on Post Card

For Checking Pressure Instruments

Eight-pp Bulletin 363 describes test gages and gage testing equipment, including master reference gages, dead weight testers and test pumps, pocket and vacuum test gages, others. Manning, Maxwell & Moore, Inc.

For a copy, circle 143 on Post Card

For Liquid Metering Service

Illustrated in 20-pp Catalog P-100 are Rotocycle meters designed to meter any liquid from solvents or LPG to heavy crudes. Explains Rotocycle principle and includes dimensions and specifications. Rockwell Mfg. Co.

For a copy, circle 144 on Post Card

Variable Area Flow Meters

Twenty-pp Catalog 520.100, on glass-tube type Varea-meters, contains information on industrial applications, features and details of several tube and float types. Provides selection and data. Wallace & Tiernan Inc.

For a copy, circle 145 on Post Card

For Measuring Radioactivity

Illustrated and described in 96-pp Catalog S are more than 250 instruments, many recently introduced. They include counting systems, scalers, gamma-ray spectrometers, logic systems, ratemeters, portable survey meters, detectors, neutron generators, training instruments, radio-nuclides and others. Nuclear-Chicago Corp.

For a copy, circle 146 on Post Card

Basic Timing Instruction

Concentrating on practical information, this 72-pp manual explains time controls and circuitry and progresses to complex application diagrams. Intended to promote understanding of principles and applications, it covers construction of time controls; switches and circuits; function of elapsed time indicators; cycle, interval, time delay and reset timers. Haydon Div., General Time Corp.

For a copy, circle 147 on Post Card

(More Bulletins on page 196)

FIRST CLASS
PERMIT No. 11
BARRINGTON, ILL.

BUSINESS REPLY CARD

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY—

Plant Engineering

308 EAST JAMES STREET

BARRINGTON, ILLINOIS

Remove Reply Cards on Perforation

PLEASE THINK OF THE *NEXT* READER! When removing the first card from this sheet please remove it with care. One of the "pass-along" readers may wish to request bulletins, information, tear sheets or reprints. The redesigned "fire stop" in the perforations makes it easy to remove one card without disturbing the other.

Name _____ Title _____

Company _____

Company Address _____ City _____ State _____

JULY, 1961
Void after 3 months from above date

EQUIPMENT

1	2	3	4	5	6	7
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Name _____ Title _____

Company _____

Company Address _____ City _____ State _____

JULY, 1961
Void after 3 months from above date

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"Runs quiet and cool"

. . . because this Gardner-Denver air-cooled compressor is installed complete with aftercooler and silencer. Provides dependable, low-cost air power . . . is ideal for departmental or auxiliary air power. Runs for years with just routine attention. Choose from a complete air-cooled line. Write for bulletin.

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EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

MAHON'S INDUSTRIAL EQUIPMENT DIVISION . . .

designs equipment but engineers results

from start to any finish your products require . . . in a coordinated, fully responsible, one-source service

The 'finishing touch' of Mahon means more than just painting equipment—it means peak-efficiency methods for the best finishing of quality products. Mahon's Industrial Equipment Division provides a unique one-contract service that is safe, sure—and more often than not, the most economical—answer to any industrial finishing problem. Mahon's multiple-area benefits are worth investigating. Get in touch with Mahon and prove it for yourself.

Mahon
industrial equipment

complete finishing systems • metal-cleaning equipment • pickling equipment • painting facilities—spray, dip and flow coating • drying and processing ovens • special process equipment

2 fabrication
of approved design is made, tested, shipped and installed by one organization—Mahon . . . to facilitate use.

3 erection & installation
of equipment and structures is speeded by skilled Mahon crews, completely familiar with finishing systems.

4 service
by Mahon means constant, trouble-free production of your quality products for maximum investment return.

WRITE FOR MAHON CATALOG A-661—ALSO IN SWEET'S P. E. FILE

YOUR BIGGEST VALUE IS IN MAHON'S PLANNING & ENGINEERING EXPERIENCE

THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

MANUFACTURING PLANTS—
Detroit, Michigan and Torrance, California
SALES-ENGINEERING OFFICES—Detroit, New York, Chicago, Cleveland, San Francisco, Torrance and E. Orange, N. J.

MAHON

Circle 523 on postcard, page 33

← Circle 522 on postcard, page 33

If you use or design for compressed air

...and don't have this new catalog...

be sure to send for it *today!*

Please fill out this coupon or write on your company letterhead

FOUNDED IN 1926

C.A.NORGREN CO.

344 SOUTH ELATI STREET
ENGLEWOOD, COLORADO

To: C. A. NORGREN Co., 3443 So. Elati St., Englewood, Colo.

Gentlemen: Please send me without cost or obligation your new catalog, No. 1000, on the complete Norgren line of pneumatic products.

Name_____
(Please print)

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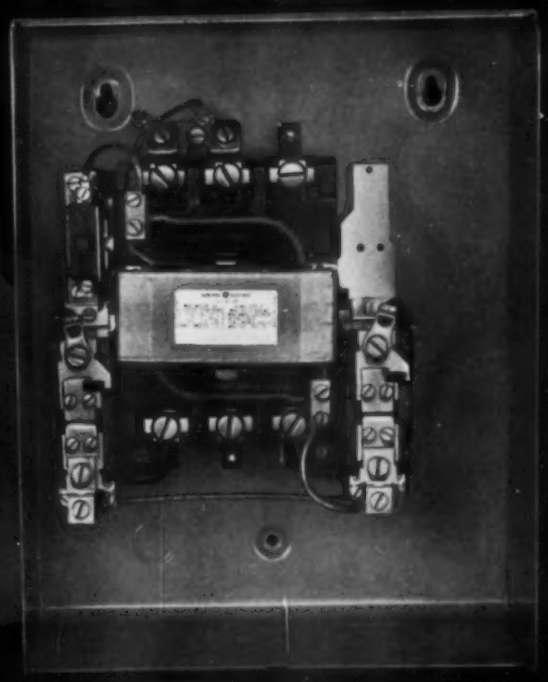
Company Name_____

Company Address_____

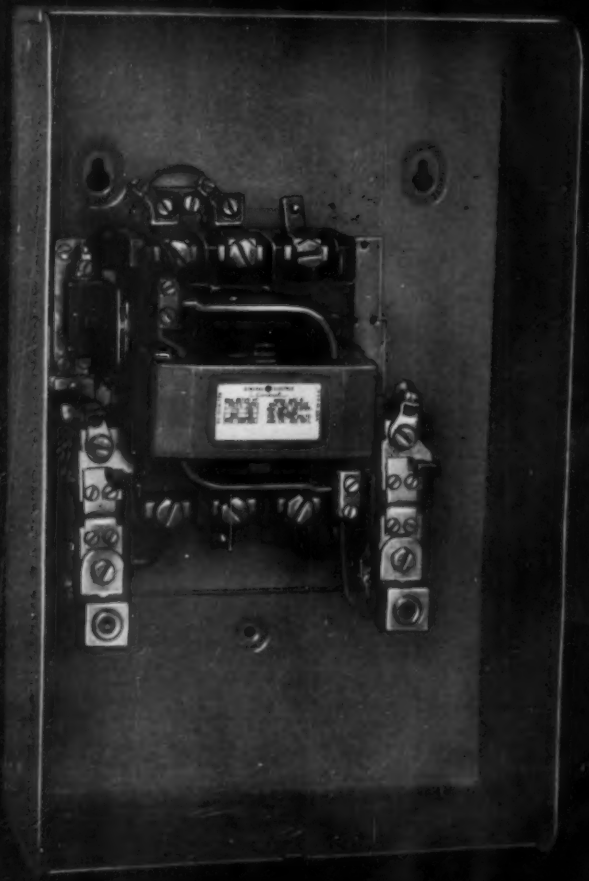
Circle 524 on postcard, page 33

From General Electric . . .

NEW NEMA SIZE 3 NEMA SIZE 4 STARTERS



SIZE 3



SIZE 4

Field-proved 100-Line design—now available in Sizes 00 through 4—offers you unmatched savings in maintenance time and dollars.

Inspect Contacts, Change Coil Without Tools Even on Size 4!

Imagine how much maintenance time and expense you can save with these new General Electric 100-Line starters! Without using even a screwdriver, you can inspect contacts in *10 seconds*, change coil in *20 seconds*. This is convenience no other starter can offer.

These new 100-Line Sizes 3 and 4 starters also give you the benefits of a design *field-proved* on over one million applications:

- Straight-through wiring saves hook-up time. All line terminals are on top, all load terminals on bottom.
- Pressure-type terminals accept wire through size 1/0 on Size 3 and 250 MCM cable on Size 4.
- Durable molded Strongbox coil resists dirt, moisture, oil, and mechanical damage.
- Slanted contacts shrug off dust and other contaminants.
- Wedge-action contacts close at an angle to reduce bounce and resultant arcing and pitting.

New General Electric 100-Line Sizes 3 and 4 starters are now available, enclosed or open, in all popular forms. Call your G-E sales engineer or distributor. Or, write for new publication GEA-7326, to Section 813-36, General Electric Co., Schenectady 5, New York.

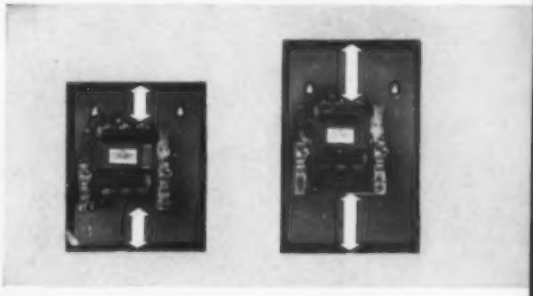
You Get MEASURABLE ADVANTAGES WITH GENERAL ELECTRIC CONTROL

Progress Is Our Most Important Product

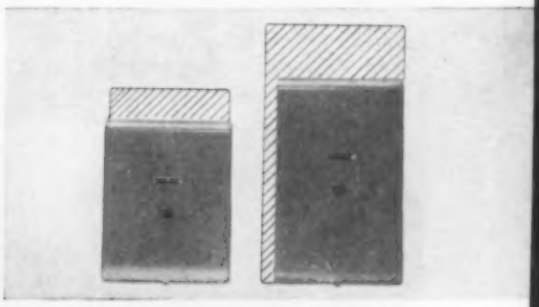
GENERAL ELECTRIC

Inspect all contacts in 10 seconds without tools. Simply lift off spring-loaded retainers on upper right and lower left of coil. Entire movable assembly—including contacts, magnet, and coil—slides out for inspection. Both stationary and movable contacts are visible.

Change coil in only 20 seconds without tools. Lift off the two coil retainers and slide out movable contacts, magnet, and coil assembly. Remove spring-clip in "I" magnet and take off "I" magnet. Molded Strongbox coil can now be lifted off the "E" magnet.



You get plenty of wiring room. Enclosures on these new starters give you 3¼ inches of wiring space at top and bottom on Size 3; 5½ inches top and bottom on Size 4. All line terminals are at top, load terminals at bottom for easy hook-up.



Significantly smaller than previous forms. New enclosed 100-Line starters are 9% to 23% smaller in area, fit where others won't. Size 3 enclosure is only 15⅛ inches high, 12⅛ inches wide, 7⅞ inches deep. Size 4 is 20⅛ x 12⅛ x 7⅞ inches. (Depth dimensions include reset button.) Compare with other makes.

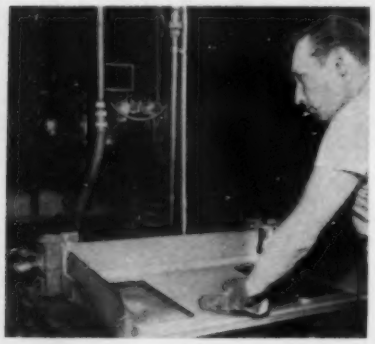
Circle 525 on postcard, page 33

PLANT ENGINEERS' DIGEST®—so those who rush may read and know what's new

Edited by Bea Berghorn

Annealing Method Reduces Rejects

ANNEALING of stovetop corners was being done with an oxyacetylene torch. This method was resulting in rejects because of crazed enamelled finishes and was also tying up the production line.



Stovetop stamping is placed in fixture on table. Heat is then focused on stovetop corners by the operator.

This production problem was solved in the Welbuilt Corp. plant in Maspeth, N. Y. with a simple table-top combustion system.

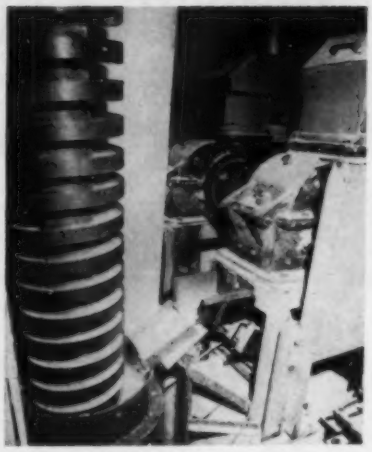
The combustion system employs high temperature, high velocity Superheat burners, an automatic combustion controller for delivery of precise gas-air mixtures to the burners, a firecheck for extinguishing flashbacks that might occur, and a solenoid valve.

Burners are mounted in each back corner of the table in such a manner as to focus heat precisely and uniformly on the stovetop corners. When the operator places a stovetop stamping in the fixture on the table, the workpiece presses against a microswitch timer button. The solenoid valve is then actuated, gas-air mixture is admitted and idling burners are brought to operating capacity to heat and anneal the workpiece.

After a predetermined heating cycle ranging from seven-and-one-half to nine-and-one-half seconds, only half the time previously required, the timer switch turns down the burners to idling. *From a release of Selas Corporation of America, Dresher, Pa.*

Spiral Elevators Feed and Cool

PROCESSING frit flakes at approximately 1400 to 1600 lb an hour, spiral elevators cool, elevate and feed highly abrasive material in the manufacture of bagged enamel products.

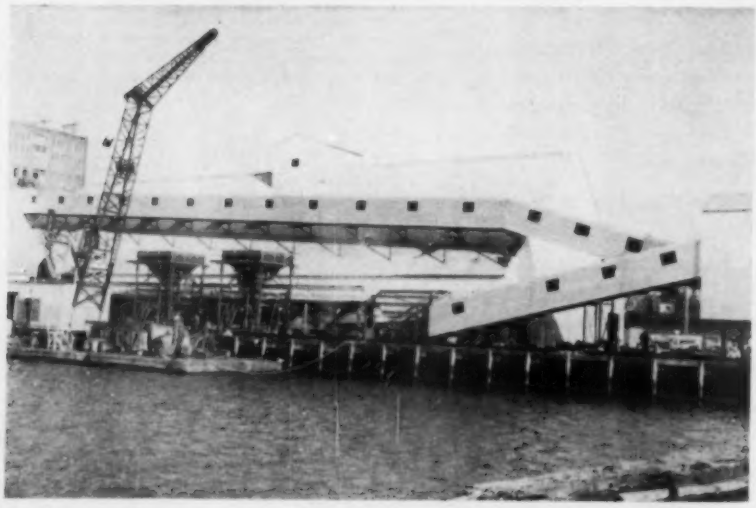


Electromagnetically vibrated 3600 times a minute, elevators provide dependable feeding for bulk materials.

In operation for almost a 24-hr daily production schedule over a period of years, Ferro Enamels, Ltd., Oakville, Ontario has experienced very few maintenance problems. These spiral elevators contain no mechanical parts and require no supporting structural framework.

Discharged from the final processing operation before bagging, the frit flakes enter the spiral elevator at temperatures between 500 F and 600 F. Rate of feed is maintained at production speed by an adjustment of the power of vibration, which can be varied by turning the rheostat knob. By the time the material has traveled the height of the elevator, the temperature is sufficiently lowered to permit immediate bagging. *From Syntronics, published by Syntron Co., Homer City, Pa.*

Ship-To-Shore Handling System Doubles Unloading Capacity

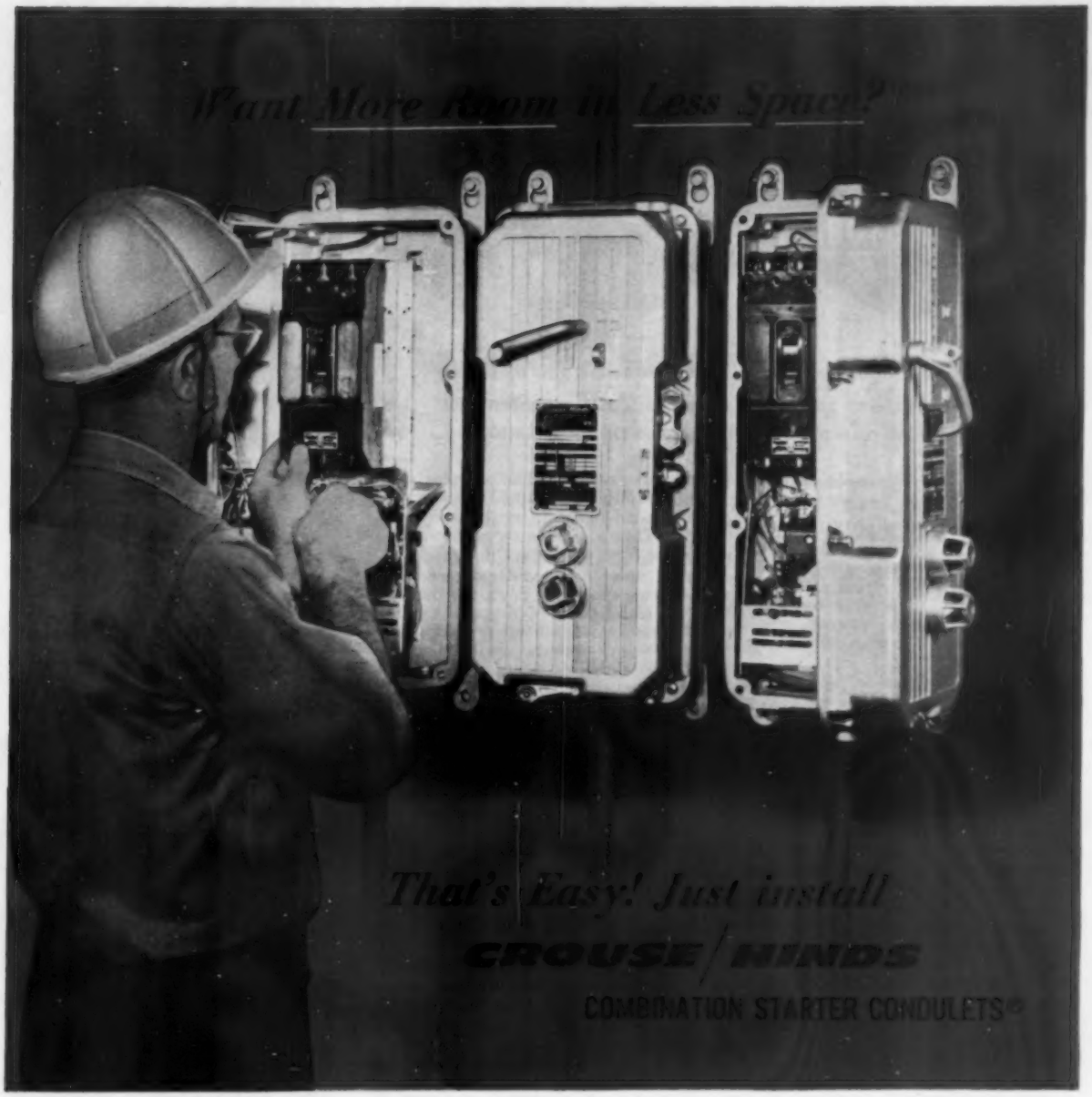


New ship-to-shore unloading system installed on the dock of Refined Syrups and Sugars, Inc., Yonkers, N. Y., handles about 300 tons of raw sugar per hour instead of 150 tons previously. Sugar is now delivered in bulk instead of in bags. From a release of Coyle and McDonald Co., Inc., Passaic, N. J.

Plastic Breakers Prevent Toxicity

INSTALLATION of all-plastic vacuum breakers has proved successful at Parke, Davis and Co., Detroit. These breakers prevent back-siphonage and guard against contamination of high-purity water necessary in the production of pharmaceuticals.

The units replaced backflow-prevention devices made of metals which tended to introduce traces of metal in the water, thus contributing to



Sure, they'll take any-make starter or circuit breaker. The door swings open right or left. Doesn't make any difference which. You always have plenty of room to work. And plenty of future capacity, too. Crouse-Hinds DMC/WMC's can be had with pilot-light holes, push-button holes, or selector-switch operating-shaft holes already drilled, tapped and plugged. Installation is always simple, fast, permanent. Dismounting just as easy, should you need to move to a new location.

Plenty of other advantages make for ease, endurance and economy. For example: Both the dust-ignition-proof DMC and the watertight WMC are strong, lightweight and corrosion resistant, made from top-quality *cast* aluminum. Each is designed for flexibility and for low-cost installation.

Ask your Crouse-Hinds Distributor for details. You can't go wrong. The dust-ignition-proof DMC conforms to National Electric Code Class II, Groups E, F, G and NEMA Type 9 EFG. While the watertight WMC conforms to NEMA Types 3, 3R, 4 and 5.

CROUSE HINDS
SYRACUSE NEW YORK

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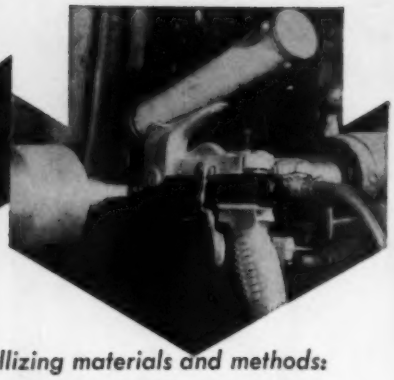
Circle 526 on postcard, page 33

DO YOU KNOW WHAT METALLIZING CAN DO FOR YOU TODAY?



With today's improved metallizing materials and methods:
***Plant executives* find new ways to slash maintenance costs, reduce downtime, cut machine parts inventory...**

These real-life examples show how plants save money with metallizing:

Necks of winding rolls in a textile mill were formerly repaired by a slow machining method, requiring highly skilled labor. Now the worn necks are built up with flame sprayed metal, quickly machined to size. Savings run $20,000 a year.

Valve plugs and seats, working in sand, oil and salt water, lasted only a few hours in service. Hard-faced by welding, a set cost $155, lasted from 3 to 8 hours. When flame sprayed with tungsten carbide powder, service life was increased to a minimum of *2 weeks,* 4100% longer! Cost of metallized set, $73. But reduced downtime far outweighs the dollar savings.

A Connecticut company was sending its worn shafts out for repair by welding at a cost of $50 each. Then they found a local shop that specialized in metallizing was able to do a better job for $27.50. The same job shop salvaged a big degreasing tank, value $2,850, by flame spraying with zinc for $683. The shop made money, the customer saved money.

A shipbuilding company installed metallizing equipment to repair such parts as pump rods, pistons, crank shafts for diesel engines, stern bushings, valve stems. A badly worn tugboat shaft, replacement cost $3,000, was repaired and made better than new for $400. That job alone more than paid for the METCO equipment.

From these cases you can see how modern metallizing pays, whether in plant maintenance departments or in job shops serving the many companies that don't need their own installation. Wherever there's wear, in rotary or sliding action, there's an opportunity to save money and make money.

New and improved materials

Among these new materials are a number of nickel, chrome, boron hard facing powders. Sprayed tungsten carbides are also widely used. Many others are available to give new values to the basic benefits of metallizing, which may be summarized as: less downtime; far less machining or grinding time, reduced parts inventory; and "better than new" performance of the metallized parts.

With savings like these there are big opportunities for more efficient maintenance operations, either with METCO installations or through local job shops.

To explore these advantages and see how they apply to your operation, check the coupon below and send it off today.

METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies

1195 Prospect Avenue, Westbury, L. I.
New York Telephone: Edgewood 4-1300
Cable: METCO. In Great Britain: METCO, Ltd., Chobham-near-Woking, England

METCO INC., 1195 Prospect Avenue, Westbury, L. I., New York

How to SAVE MONEY and cut downtime with Metallizing

☐ Send copy of Bulletin 15, "How to Save Money and Cut Downtime with Metallizing"
☐ Have Field Engineer Call

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Company _____
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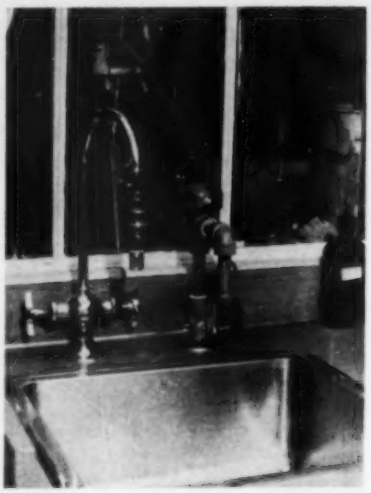
Circle 527 on postcard, page 33

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)



Lab sink piping showing all-plastic vacuum breakers used in water lines.

ionization problems. Unplasticized polyvinyl chloride was specified to guard against toxicity and impurities in distilled and deionized water lines.

UPVC vacuum breakers were used in ⅜-in., ½-in., and ¾-in. lines operating at room temperatures at 15 psi pressure. Both solvent-cemented and threaded joints were employed, as well as threaded joints for transition from other lines.

All-plastic movable discs are used in the vacuum breakers. These move up to close air vents and permit free flow of water or other liquid, then seat themselves in vacuum-tight seals when the flow stops. They were tested against vacuums up to 28 in. of mercury with no indication of back-siphonage. *From a release of Tube Turns Plastics, Inc., Chemetron Corp., Louisville, Ky.*

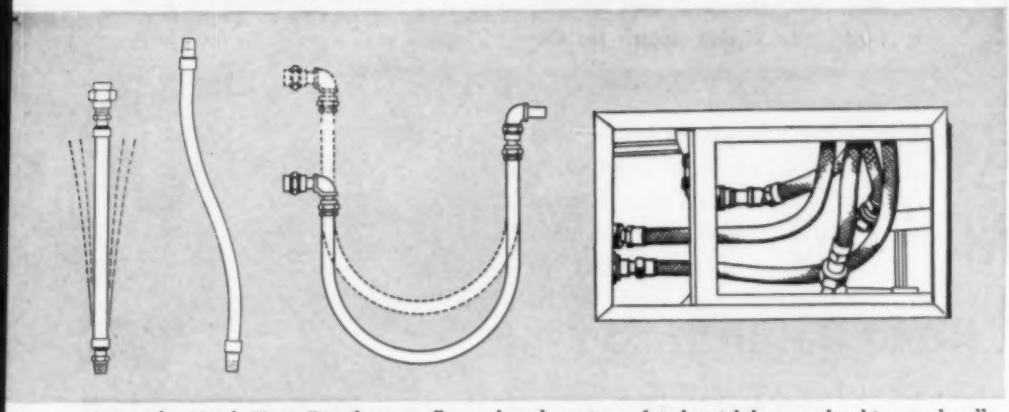
Rubber-Lined Chute "Digs" Coal

USE OF bonded rubber lining in chutes and hoppers has solved chronic maintenance problems in coal handling equipment at the Municipal Electric Light plant, Hagerstown, Md.

After handling 120,000 tons of bituminous coal with equipment fabricated of copper-bearing steel, the abrasive action of the coal and the corrosion from its wet sulfur content resulted in deterioration of the chutes.

After extensive tests, mild steel

For dependable, local service in flexible connectors see the Anaconda Metal Hose Distributor nearest you



Anaconda Metal Hose Distributors offer a broad variety of industrial hose and tubing to handle: **1. VIBRATION; 2. OFFSET; 3. FLEXING AND MOTION; 4. Connections in CRAMPED QUARTERS.** Stocks include flexible tubing manufactured of copper alloys, steel, stainless steel, aluminum and metal-plastics combinations. You get the unseen but actual values inherent in Anaconda Metal Hose products—the result of consistently superior quality of materials and workmanship.

STOCKS. Each Anaconda Metal Hose Distributor knows the requirements of industries in his area and fits his stocks to meet these needs—for both shelf items and special assemblies.

SERVICE. Anaconda Metal Hose Distributors offer prompt, local service. A simple phone call brings you stock items. They can attach fittings and make up assemblies for a variety of special needs.

The need for flexible connectors is universal—in piping for new construction, plant modernization. These connectors take up piping travel, absorb vibration, connect offset outlets.

Sometimes the need for a flexible connector is urgent. That's when a reliable Distributor can be of greatest service to you. Anaconda Metal Hose has such reliable Distributors in strategic locations all over the country. They stock. They attach end fittings. They're working with Anaconda products—superior in design and manufacture.

Your Anaconda Distributor carries stocks that fit in with his area's demand pattern. He's a local businessman who knows local business conditions. He keeps track of new business as well as changing requirements of those already established.

Talk over your needs for metal hose and flexible tubing assemblies with the Anaconda Distributor nearest you. You'll be as glad to be associated with him as we are. 61132

AKRON, OHIO The Hardware & Supply Co.
ALBANY, N. Y. Sager-Spuck Supply Co., Inc.
ALBUQUERQUE, NEW MEXICO Geo. S. Thomson Co. of New Mexico
ATLANTA, GA. J. M. Tull Metal & Supply Co., Inc.
BALTIMORE, MD. Robins Rubber Division of A. K. Robins & Co., Inc.
BIRMINGHAM, ALA. J. M. Tull Metal & Supply Co., Inc.
BOSTON, MASS. A. E. Borden Co., Inc.
BRIDGEPORT, CONN. R. B. Birge & Co.
BROOKLYN, N. Y. Utility Brass & Copper Corp.
BRUNSWICK, GA. Parker, Helms & Langston, Inc.
BUFFALO, N. Y. Peerless Mill Supply Co. Inc.
CANAL WINCHESTER, OHIO Hersh Packing & Rubber Co.
CHARLESTON, W. VA. Parsingers, Inc.
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CINCINNATI, OHIO Vulcan Supply & Metals Co.
CLEVELAND, OHIO W. H. Summers Rubber Co.
DALLAS, TEXAS Texas Rubber Supply, Inc.
DAYTON, OHIO Reliable Rubber Products Co.
DENVER, COLORADO Hendrie & Bolthoff Co.
DES MOINES, IOWA L. H. Kurtz Co.
DETROIT, MICH. Yale Rubber Mfg. Co.
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LONG BEACH, CAL. Barnes & Delaney
LOS ANGELES, CAL. F. D. Delafield Co.; Industrial Product Sales Co.
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MASSILLON, OHIO The Hardware & Supply Co.
MIAMI, FLA. J. M. Tull Metal & Supply Co., Inc.
MILWAUKEE, WIS. Great Lakes Rubber & Supply, Inc.
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NASHVILLE, TENN. Nashville Machine & Supply Co.
NEWARK, N. J. Couse & Bolton Co.
NEWARK, OHIO Lucas Supply Co.
NEW ORLEANS, LA. C. V. Harold Rubber Co.
NORFOLK, VA. Diesel Injection Sales & Service, Inc.
ODESSA, TEXAS Geo. S. Thomson Co. of Odessa
PHILADELPHIA, PA. Cooney Brothers, Inc.
PHOENIX, ARIZ. Geo. S. Thomson Co., Inc.
PITTSBURGH, PA. Follansbee Industrial Sales, Inc.; Reynolds Supply Co.
PORTLAND, ORE. Peterson Industrial Products, Inc.
PROVIDENCE, R. I. Allen & Reed Co.
ROCHESTER, N. Y. Ontario Metal Supply Inc.
SALT LAKE CITY, UTAH Metals Supply Co., Inc.
SAN FRANCISCO, CAL. Milligan-Spike Co.
SEATTLE, WASH. Washington Belting & Rubber Co.
ST. LOUIS, MO. Corby Supply Co. McDonald & Wilson Sales Co.
SYRACUSE, N. Y. Syracuse Supply Co.
TACOMA, WASH. Washington Belting & Rubber Co.
TAMPA, FLA. J. M. Tull Metal & Supply Co., Inc.
TOLEDO, OHIO Derkin & Wise, Inc. Mill & Factory Supply Co.
TRENTON, N. J. Sinclair Industrial Supply Co.
TULSA, OKLA. Miller Equipment & Mfg. Co.
WASHINGTON, D. C. Thos. Somerville Co.
WEST HARTFORD, CONN. Faxon Engineering Co., Inc.
WEST MONROE, LA. Central Supply Co., Inc.
YOUNGSTOWN, OHIO Youngstown Rubber Products Co.

ANACONDA® METAL HOSE

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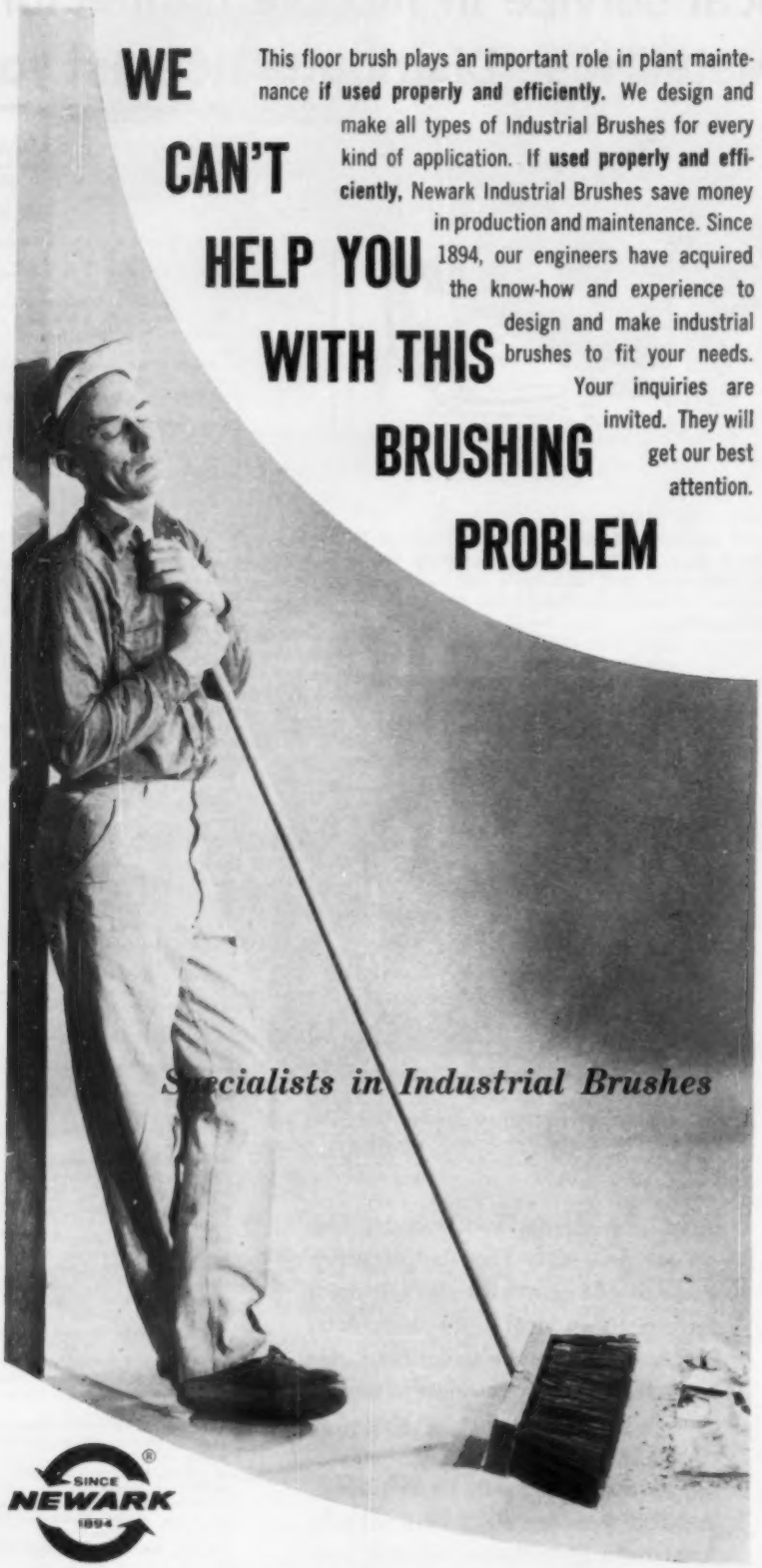

WE CAN'T HELP YOU WITH THIS BRUSHING PROBLEM
This floor brush plays an important role in plant maintenance if used properly and efficiently. We design and make all types of Industrial Brushes for every kind of application. If used properly and efficiently, Newark Industrial Brushes save money in production and maintenance. Since 1894, our engineers have acquired the know-how and experience to design and make industrial brushes to fit your needs. Your inquiries are invited. They will get our best attention.
Specialists in Industrial Brushes
SINCE NEWARK 1894

Leadership Proved Through Performance! 59-54

NEWARK BRUSH COMPANY

260 MICHIGAN AVE., KENILWORTH, N. J.

Circle 529 on postcard, page 33

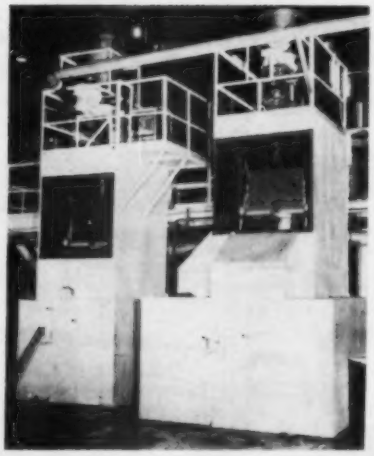
PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

chutes, with a protective layer of rubber bonded in place before installation, were used. The lining material is an abrasion-resistant compound of Plioweld. No evidence of wear has been noted after five months and 25,000 tons of coal being poured through the chutes.

Noise reduction and less scattered coal dust through the plant are extra benefits. *From a release of Goodyear Tire and Rubber Co., Akron, Ohio.*

For Safety's Sake



To prevent any toxic powder from entering working areas, Beryllium Corp., Hazleton, Pa., places sifters in a sealed enclosure. Each enclosure is fitted with a clear plastic panel front which permits observation and unit access. From a release of Sprout, Waldron & Co., Inc., Muncy, Pa.

Two-Section Bridge Aligns Itself

TO COMPENSATE for irregularities in the plant floor, a cross-over bridge of unusual design has been built for installation in the plant of Tension Envelope Corp., of Kansas City, Mo.

The bridge is a two-section structure, with both sections hinged to the floor at each side of a sunken railroad spur track. The track, which cuts through the center of the plant, is curved at this point, and banked—so that the deck of the bridge must align itself automatically with the floor contour on each side when in the down position. Each section of the bridge is eight feet wide and nine feet long with a 15,000 lb capacity.

Together, the sections form an 18-

SILICONE NEWS from Dow Corning

Now...Time for the Boys

Electrical Problems No Longer Short Circuit Our Family Fun

Sure, a father should be a pal to his sons . . . and, mine are at the age when they need and appreciate my companionship most. But when you're lucky enough to be employed at an assembly plant that's doubled capacity twice in the past eight years, you've got more than a full time job . . . and family activities frequently have to take a back seat.

During these eight years I've come up through maintenance to Assistant Plant Manager. It started when I suggested we replace certain troublesome motors with silicone insulated units. Then, when we doubled our plant the first time, I suggested we could double our electrical load capacity in the same floor space by using silicone insulated transformers. Just before our last expansion, my boss was made Plant Manager and I moved up to his assistant. He's taught me a lot . . . and I think I've helped him. We're a good team. And, for the first time since I started working, I'm finding time to really enjoy my boys. By the way, the car we're restoring is a Model A. No, not a Ford . . . a Dusenberg.

I think my progress is the result of plenty of hard work and a good eye for new and better ways of doing things. One of the most important things I've ever read was an advertisement on Dow Corning silicone insulation for electrical transformers and motors—just as you're doing now. I wrote for more information. Why don't you?

For brochure, "Specify Silicone Insulation and Save", Write Dept. 0819.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Circle 530 on postcard, page 33

Leads the way to

DEPENDABLE LIFTING

...quality leader in electric chain hoists

performance... the real test

Many thousands in all types of service demonstrate that you, too, can profit from more efficient Lodestar handling...at lower costs and increased productivity.

attractively priced...

Initial cost surprisingly low...operates for pennies per day...built to serve you without costly maintenance.

end your hoist problems...

Select Lodestar from a complete range of capacities and speeds...⅛ to 2 tons and 8 to 60 fpm. Interchangeable lug, hook and trolley suspensions.

Outstanding Lodestar® features include...

CONVENIENT PUSH BUTTON OPERATION—Precise and safe load control.

LOWEST HEADROOM—For highest lifting... unmatched by any other hoist of similar type.

HEAVY DUTY PERFORMANCE—Ruggedly constructed to withstand the heavy demands of severe service.

DEPENDABLE DUAL BRAKING—Instantaneous acting, self-adjusting magnetic brake, plus ultra-modern regenerative electric braking.

FLEXIBLE WELDED LINK CHAIN—Famous CM-ALLOY type flexes freely in all directions... permits angle lifting ... easily inspected... extremely long wearing.

MINIMUM MAINTENANCE—Introduces new standards of maintenance-free service.

Request catalog and name of local stocking distributor

CM HOISTS

CHISHOLM-MOORE HOIST DIVISION
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CHICAGO • CLEVELAND • SAN FRANCISCO
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Circle 531 on postcard, page 33

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

Pushbutton-controlled bridge automatically aligns with contour of floor.

ft cross-over route permitting fork trucks and other traffic to take a short-cut from one plant area to another. The unit is controlled from either of two pushbutton stations located on each side of the track.

The hydraulic cylinders are synchronized so that one section lowers first and rests horizontally on folding legs. The other bridge section then lowers to a supporting ledge provided by the first. *From a release of Globe Hoist Co., Industrial Lift Div., Philadelphia, Pa.*

Avoid Concrete Scaling Problems

CONCRETE pavements, parking areas, walks and curbs frequently are subjected to severe exposure. For good results, here are some concrete tips:

With 1½-in. top-size aggregate, air content in the five to six per cent range is required. For ¾-in. or 1-in. top-size aggregate percentage should be six to seven.

Fine and coarse aggregate should meet ASTM C-33 or have a suitable service record. The cement should meet ASTM C-150, C-175, or C-205, should be of normal temperature at time of delivery.

Proper placing and finishing are essential to long wearing surfaces.

Surface treatments of oil increase resistance to scaling. Boiled linseed oil applied to the clean, dry concrete, or mineral oils are acceptable.

Don't add water to concrete. This lowers strength and increases absorption, permeability and likelihood of scaling. If increased workability is re-

quired, have the concrete mix altered at the batching plant.

Coarse aggregate with high percentages of unsound particles will contribute to pop-outs and scaling. Cement that fails to meet specification for false or flash setting tendencies or the use of hot cement can contribute to scaling and early distintegration.

Excessive or premature bullfloating, darbying or hand or machine floating, particularly with metal tools, contributes to bleeding and reduces air content and durability of the surface. Swirled or smooth finishes may be obtained using hand floats or trowels after the concrete has stiffened.

Concrete should be kept moist during the entire curing period. Alternate wetting and drying during the early age of concrete will cause crazing and will also increase the possibility of scaling.

Unsealed concrete less than one year old, may scale from the effects of salt. Where the presence of de-icing agents cannot be eliminated (e.g. drippings from automobiles, etc.) the concrete surface must be treated with a sealer prior to the first winter if scaling is to be avoided. *From a release of Master Builders Co., Cleveland, Ohio.*

Giant Magnet Cleans Effectively

An effective tool we use to clean the plant highways and storage yards is a giant magnet mounted on a fork lift truck. Components are a circular magnet, weighing anywhere from 4000 to 9000 lb, and a 15-kw gasoline driven generator. Both generator and magnet are controlled by operator inside the cab. From a release of Timken Roller Bearing Co., Canton, Ohio.

Fuller Portable Airveyor® Transfer Units convey pelletized or granulated plastics and similar materials with high efficiency . . . provide a self contained loading and unloading unit for greater flexibility.

FULLER low cost transfer unit expedites handling of granular chemicals and plastics

Get high conveying capacity—when and where you want it—without the expense of duplicating equipment. Fuller Portable Airveyor® Transfer Units provide flexible, lower-cost handling to and from cars, trucks, storage bins and silos of every type. Hook-ups are quicker, too, because these Fuller units use pipes, hoses and nozzles of minimum size to deliver maximum capacity. Units combine clean-cut appearance with compactness and stamina never before available in portable equipment. Made in three sizes, the units are rated to handle pellets from 4 to 20 tons per hour for conveying distance of 30 feet on the suction side and 100 feet on the pressure side.

For full details, write for Bulletin A-23.

See Chemical Engineering Catalog for further details and specifications.

4083
A296

FULLER COMPANY GENERAL AMERICAN TRADE MARK

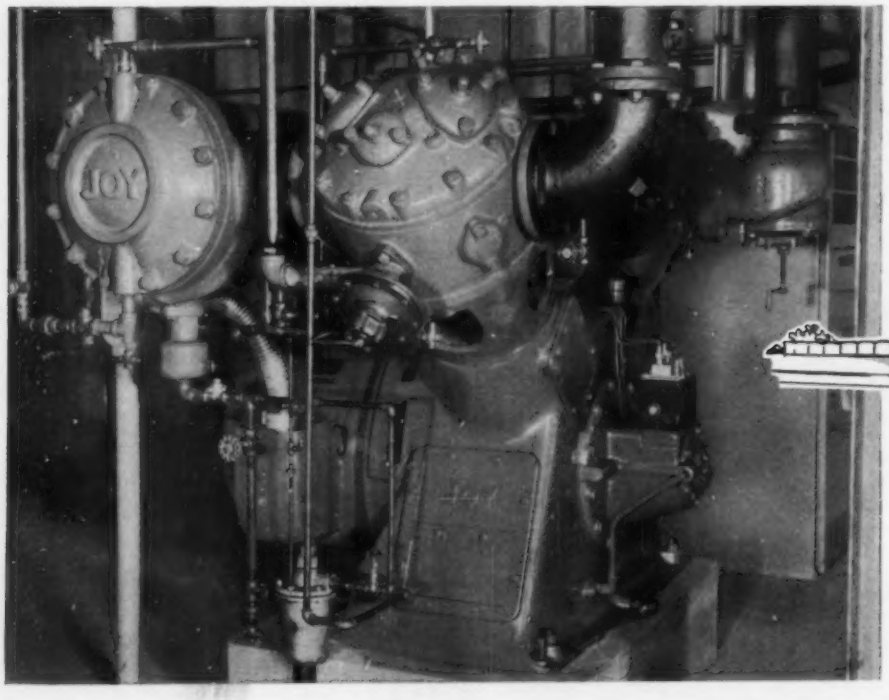
FULLER COMPANY
138 Bridge St., Catasauqua, Pa.
Subsidiary of General American Transportation Corporation
Offices in Principal Cities Throughout the World

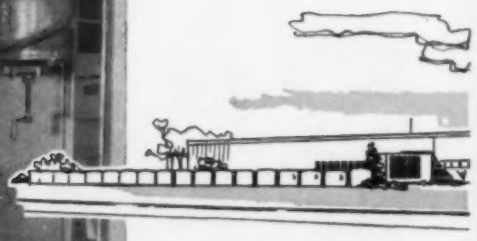
Fuller
. . . pioneers in harnessing AIR

Circle 532 on postcard, page 33

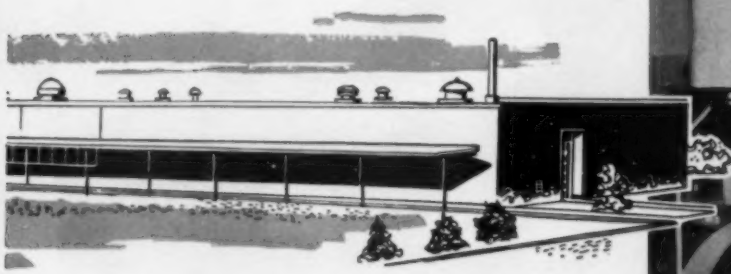
MINIATURE PRECISION CHOOSES JOY FOR AWARD

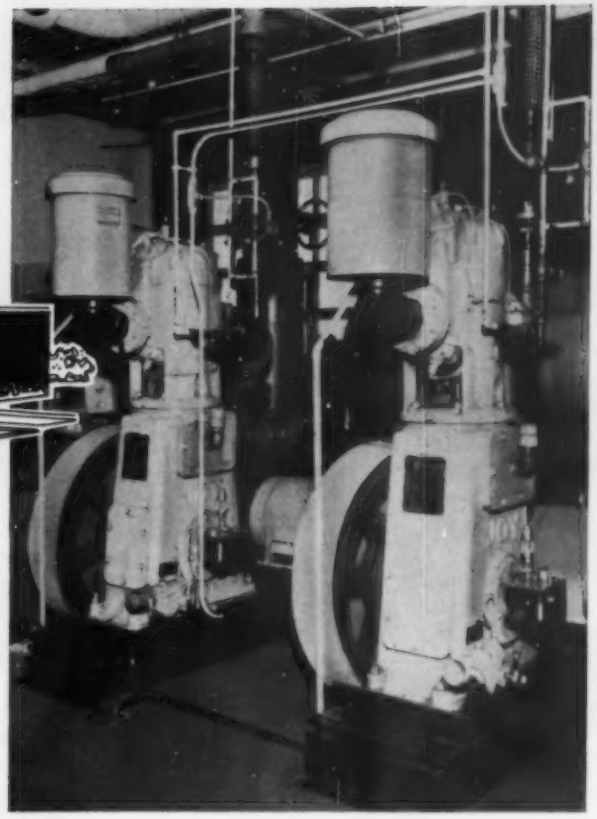
This Joy WN-112 compressor is installed in MPB's Keene, N. H. Technical Center built in 1959. Rated for continuous 24 hour service, this WN-112 is a 75 hp unit, producing 468 cfm at 125 psi.





Plant of MPB's Split Ballbearing Division at Lebanon, N. H. was completed in 1958. Two Joy WG-9 vertical compressors are used for general plant air. Each unit produces 179 cfm at 125 psi.



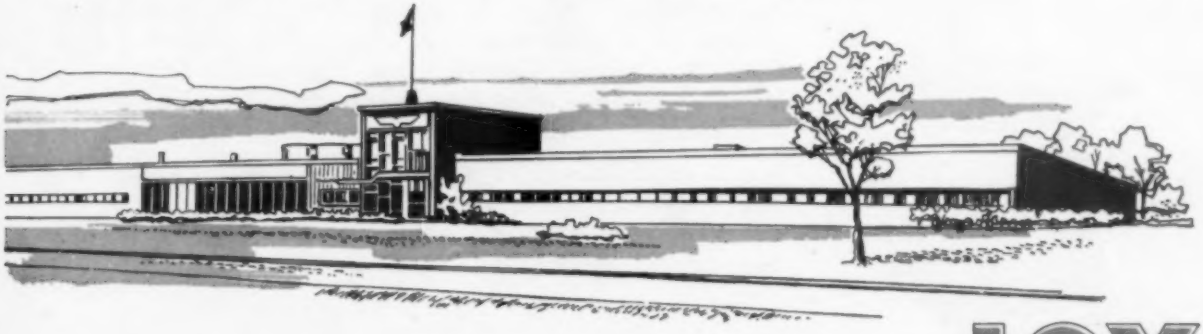


BEARINGS, INC. COMPRESSORS WINNING PLANTS

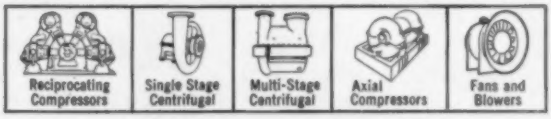
Two plants of Miniature Precision Bearings, Inc., leader in the field of sub-miniature bearings, won "Top Ten Plants" awards when they were built. Chosen for their modern, efficient facilities, they reflect the attitude of the company itself—modern, efficient, with an eye on the future. Both new plants are equipped with Joy stationary compressors.

Joy compressors are well suited for operations at MPB. Because of their compact vertical design, they are shipped as a completely assembled package. Installation is fast and inexpensive. Where some plant functions operate around the clock, Joy compressors can be equipped for automatic 24 hour service, without attendance. Features such as replaceable cylinder liners and crosshead guides, force-feed lubrication and crossheads and main bearings that never require adjustment, give reliable performance with very low maintenance cost. There are 34 standard models with capacities from 81 to 7392 cfm.

Find out why Joy compressors are chosen by the leaders in modern plant construction. Write for bulletin 1604-15.



AIR MOVING EQUIPMENT FOR ALL INDUSTRY



JOY

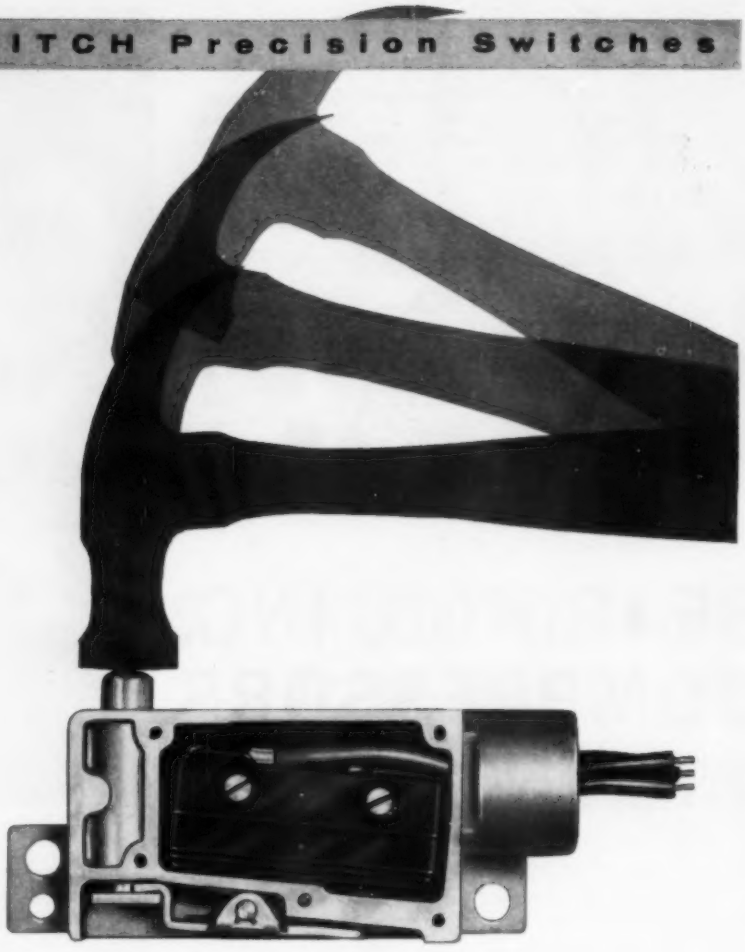
Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

Circle 533 on postcard, page 33

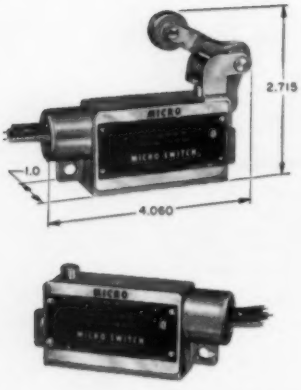
MICRO SWITCH Precision Switches

THESE SWITCHES ROLL WITH THE PUNCH — DON'T GET HURT!



HAMMER-BLOW HERE
Impact actuation of the external plunger is absorbed by a specially designed operating mechanism.

FEATHER-TOUCH HERE
A controlled force is transmitted to the diaphragm-sealed plunger of the internal switching unit.



Plunger Actuator switches and Roller Arm Actuator switches are both available in either left hand or right hand designs.

The MICRO SWITCH "LN" Switches are compact, but rugged! The high-strength enclosure and the special design of the actuator combine to withstand rapid, hammer-blow operation. A diaphragm completely seals the actuating plunger. The No. 14 insulated leads are sealed at the conduit hub. A gasket inside the cover completes the seal against oil and dust.

Two contact arrangements are available: single-pole double-throw and two-circuit double-break units. Check the compact size and you'll find that "LN" Switches fit where other switches can't! See the Yellow Pages for the nearby MICRO SWITCH Distributor or write for Catalog 83.

MICRO SWITCH . . . FREEPORT, ILLINOIS . . . A division of Honeywell
In Canada: Honeywell Controls, Limited, Toronto 17, Ontario

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Honeywell
MICRO SWITCH Precision Switches

Circle 534 on postcard, page 33

Circle 535 on postcard, page 33 →

On these four pages, you will read about a remarkable new daylighting panel--developed after more than six years of research and testing.

Like some other paneling products, it is shatter-proof, glare-free, easy and inexpensive to install.

But unlike any of them, it is the only reinforced paneling that has proven its ability to withstand corrosive fading and loss of light transmission.

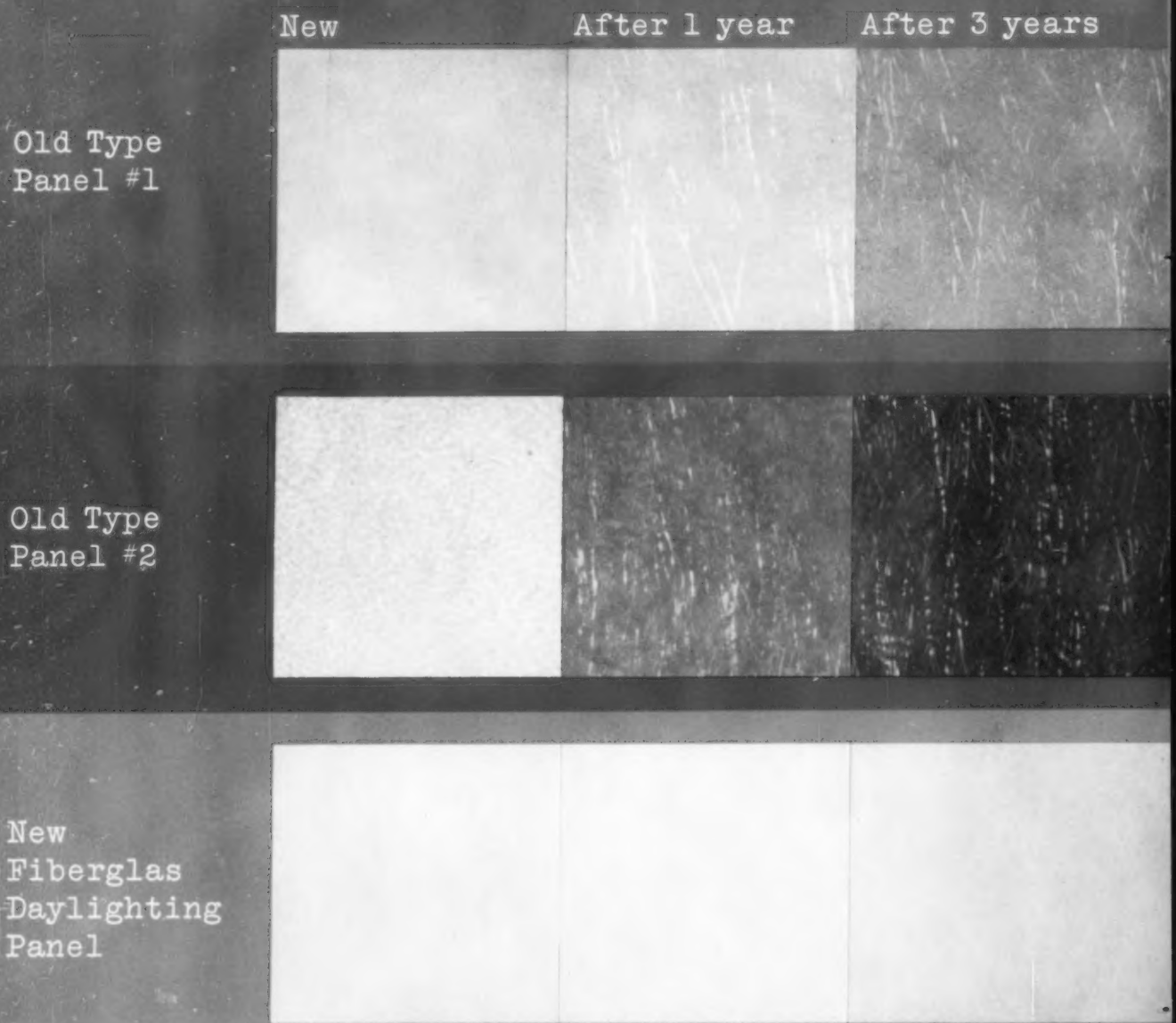
There's much more to the story on the next few pages--reasons why this is the first daylighting panel to carry the name:

OWENS-CORNING
FIBERGLAS

Here's 3-year proof!

Actual outdoor exposure tests conducted under some of the most adverse weathering conditions in the USA*, proved Fiberglas Daylighting Panels' amazing weather resistance. At the end of 3 years, all other major paneling products tested suffered considerable discoloration and fiber exposure, and up to 60% loss in light transmission! Look at the difference...

*South Florida Testing Service Co., Inc.



The actual test panels, reproduced above, are on file for your inspection at the Owens-Corning Fiberglas Research Laboratory, Granville, Ohio.

Fiberglas Daylighting Panels from Owens-Corning stay like new after 3-year test in rain, sun and salt!

Most reinforced plastic panels look pretty much alike when they're new. But what happens after two years of outdoor weathering? Or three years? Or four? That's when the difference begins to show up—and there *is* a difference. To find out, we asked an independent testing service to conduct a realistic outdoor exposure test in Florida.

Florida exposure test proves Fiberglas' long-term weather resistance

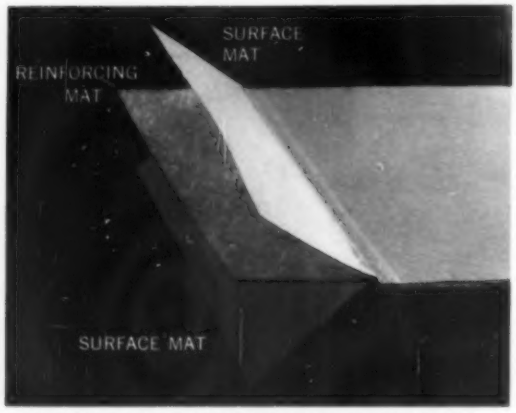
Look at the effects of weathering on typical brands 1 and 2. The resins have faded and turned dark. The surface is dull and discolored. On most panels tested, the reinforcing fibers "bloomed," or became exposed through the surface. And finally, there's been a serious loss in light transmission—as much as 60% drop from the original. Only the Fiberglas Daylighting Panel kept its original gloss and light transmission qualities—still looked like new after 3 years!

The inside story: 100% DuPont Acrylic "Lucite"* Resins and Fiberglas

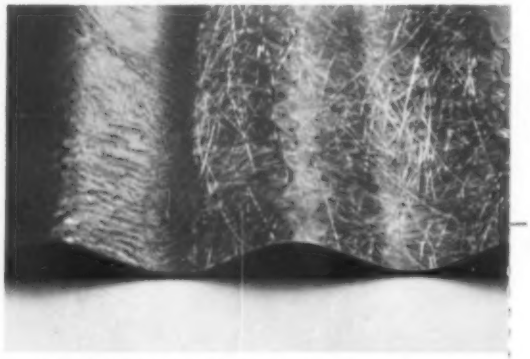
What gives Fiberglas panels their superior weather resistance? The secret lies in combining DuPont Acrylic Resins—the resin with 20 years' experience in outdoor reliability—with tough, reinforcing Fiberglas fibers. The result is a strong, shatter-proof, easily-installed panel with weather resistance second to none.

Use Fiberglas Daylighting Panels in your next building to open up dim interiors, let in natural daylight, reduce lighting costs. They're an excellent light diffuser, free from glare or "hot spots." And you can select the color and light transmission properties for your panel knowing that they'll *stay* that way longer than any other reinforced plastic paneling you can buy! See your local Fiberglas Representative or mail the coupon at right.

**Reg. T.M. duPont Lucite Sirup*



WEATHER-RESISTANT ON BOTH SIDES!
The surface mat of very fine glass filaments is applied to both sides of the Fiberglas reinforcing mat, to stabilize the resins on the surface, where they're needed most.



NO PROTECTION HERE!
Compare the "blooming" fibers on the right with a section of this ordinary plastic paneling that was protected from exposure (at left). Without a surface mat, the fibers at right became exposed through the surface after 3 years of outdoor weathering. Exposed fibers collect dirt and industrial fumes, ruin the appearance of the panel, cause a large drop in light transmission.

SAVE ON SASH, GLAZING, INSTALLATION!
Fiberglas Daylighting Panels cost less installed than glass and sash in any type construction. No special tools needed. Fiberglas configurations install and nest with metal siding and roofing, are also available in flat sizes to fit standard sash.

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OWENS-CORNING FIBERGLAS Daylighting Panels

For complete product data, specifications, and installation details, just drop this postage-paid coupon in the mail.

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Use Fiberglas* Daylighting Panels for roof an
skylights, partitioning, doors, fences, screens,

FOUR COLORS! FOUR SHAPES! Choose your light control from Frost, White, Light Green, or Medium Green in a complete variety of different corrugated shapes and flat.

Mail this coupon today for information!

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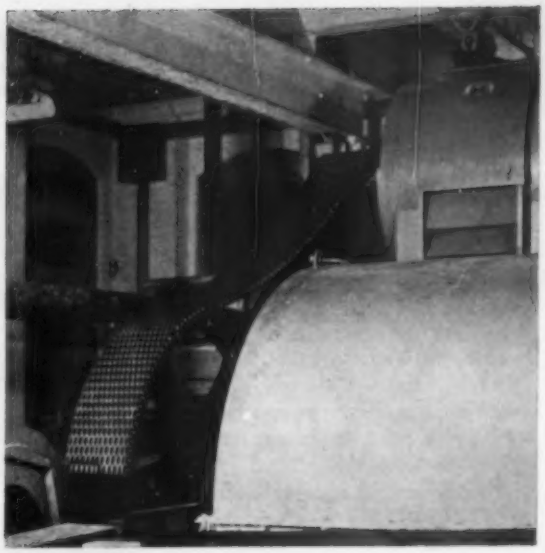
FIBERGLAS

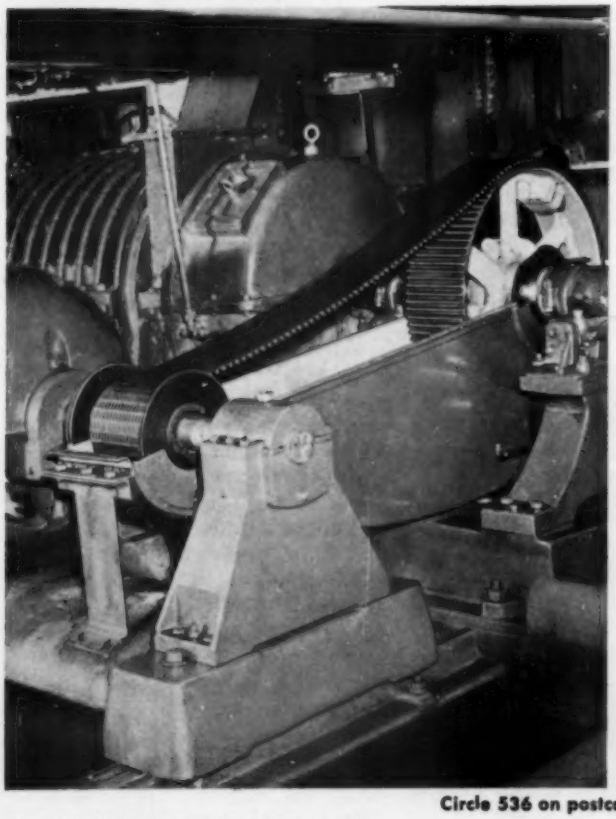
*T.M. (Reg. U.S. Pat. Off.) O-C.F. Corp.



WHERE MINIMUM MAINTENANCE AND MAXIMUM DEPENDABILITY are required of a drive, Link-Belt silent chain drives are unexcelled for light or heavy load applications. Slipless transmission of power to this pulp beater results in a high quality pulp of uniform consistency and in less time than with other types of drives.

Link-Belt silent chain

for drives that can't afford to slip



Smooth, positive engagement assures full power transmission

Continuous, nonslip operation for many years with only routine attention—this is a common experience with Link-Belt silent chain. Where other types of drives are impractical due to slipping tendencies, this modern chain drive delivers positive transmission of full-rated horsepower.

Link-Belt silent chain assures efficiency for either large or fractional-horsepower drives. Easy assembly in tight spaces permits built-in drives, compact housings. Close grouping of equipment saves valuable floor space. High humidity, temperature have no effect on performance. Ratios as high as 10-to-1 are accommodated on relatively short centers.

Available in a full range of sizes. For complete information, call your nearby Link-Belt office or authorized stock-carrying distributor. Ask for Book 2425.

WHERE SPACE IS LIMITED, compact Link-Belt silent chain drives permit close grouping of equipment. High ratio reductions are easily accommodated on relatively short centers.

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SILVERSTREAK SILENT CHAIN DRIVES

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World.

Circle 536 on postcard, page 33

← Circle 535 on postcard, page 33

OPERATION AND PRODUCTION—pointers for the industrial plant engineer

Edited by Ken Lawson

Urethane Paint Cuts Maintenance

SPILLAGE of chemicals permanently stains and removes the gloss of paint presently being used on Allied Chemical tank cars. Grease splashed from the car wheels, use of strong caustic washing solutions, abrasive effect of roadbed cinders and the year-round exposure to weather elements also helps to destroy conventional paint coatings.

To confirm the outstanding resistance of urethane coatings claimed against corrosive chemicals, abrasion and weathering, Allied Chemical has sprayed many of its railroad tank cars with urethane paint. To date, 26 tank cars have been treated. Twenty of these are from the Nitrogen Division, four from the National Aniline Division and two from the Plastics Division. The use of the new paint is expected to provide an extra-tough coating which will keep the tank cars attractive considerably longer than conventional paints.

Tank car is sprayed with urethane paint after being cleaned by sandblasting. For good coverage, surface must be free of dirt, grease, rust, moisture and loose residual paint.

Furnished by Spencer Kellogg and Sons, Buffalo, the two-package urethane paint is applied to the cars with a spray gun using 10 to 15 psi fluid pressure and 35 to 40 psi atomizing air.

Tank cars were sandblasted prior to painting with high grade flint sand which passes through a 16 mesh screen but is retained on a 30 mesh screen. A 600-cfm compressor is needed to give satisfactory cleaning action. Tank cars were painted under a shelter to keep the bare metal dry and dust-free.

Total thickness of the three coats averages 5 to 6 mils and maximum coverage was 750 sq ft per gallon per mil.

Camera Speeds Pipe Inspection

INDUSTRIAL photography has gone underground to make a visual record of coating conditions in a small diameter sewage pipe. The Jersey Testing Laboratories, Inc., Newark, N.J., with the cooperation and sponsorship of the Jersey City Sewerage Authority and Koppers Company, Inc., has completed a remote control camera inspection of 823 ft of a 24-in. concrete sewer line buried eight feet underground.

Color photographs showed test engineers that the protective coating used in the pipe was still in perfect condition after more than four years of heavy duty use under abrasive flow conditions ranging from 500,000 to 2,000,000 gallons per day.

Mounted on steel runners and carrying its own strobe-light source, the waterproof 16mm camera was conveyed along the length of the pipe by a special cable and pulley arrangement. The shutter was automatically triggered at two-foot intervals to take a 360-degree picture of the pipe interior.

Trial runs were repeated several times to check lens settings and to assure complete coverage of the pipe's interior coating surface. The Koppers' coating used on the pipe interior was Bitumastic Super Service Black, a cold-applied coal-tar coating designed particularly for this type of heavy duty use.

Fig. 1. Compact, self-contained, 16mm camera used for pipe inspection work.

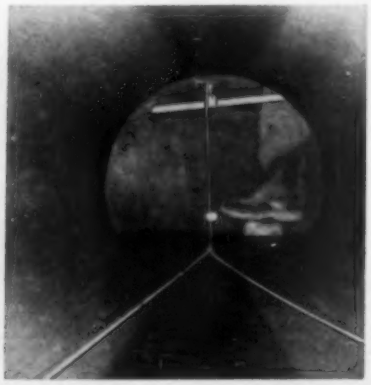

Fig. 2. Photograph of pipe interior shows harness used to pull camera.

Conditioners Go Topside

ROOF-MOUNTED conditioners, atop the Adamson-United plant in Akron, Ohio point the way to new air conditioning possibilities.

As in many buildings, no space was available for installing the equipment inside, therefore two roof-type units which require no plumbing or piping connections solved the space problem and made air conditioning possible. The conditioners are made by Dunham-Bush, Inc.

This installation has the novel application of two units mounted face-to-face. Flexibility of design made it possible to locate air cooled condensers in a manner so as to permit air movement for condensing without ducts or noise.

In addition to the space problem, air conditioning was required for engineering offices in an existing por-

ONE OF A SERIES OF CHATS ABOUT CONSERVATION AND CONTROL OF HEAT

SARCO TOPICS

SO YOU THINK YOU'VE GOT TEMPERATURE CONTROL PROBLEMS

When plant men get together and talk about their temperature control problems, strong men may weep. It's so darned basic—that narrow range of degrees which must be maintained—so closely allied to profit and loss. Let us tell you about one situation that may even top yours, and may clue you in on a good solution. It concerns wine, of all things.

Take those basic temperatures. Wine must be pasteurized at 140°F. Those are the facts of life in the world of wine. They might not seem too difficult to live with unless you are concerned with heat. Then you probably know how tough things can get when you have a rendezvous with a thermometer.

Take New York's Monarch Wine Company, producers of Manischewitz Wines. Their Problem: how to maintain the 140° temperature in the heat exchangers despite wide variations in the rate of wine flow. These variations, between 5 to 60 gallons per minute, result from slowdowns and recoveries in the bottling process. Problem: entire system must be capable of complete shutdown when necessary. Problem: wine temperatures must be raised to 140° as rapidly as possible, sometimes an immediate jump of 100°.

Attracted perhaps by aspects of the situation that had little to do with pure science, Sarco engineers applied the collective experience of Sarco technology to the solution of this serious problem. The result for Monarch: the *degree of control* the process demanded—achieved through the excellent use of Sarco Temperature-Pressure Regulators, Float Thermostatic Steam Traps Thermo-Dynamic Steam Traps, and Pipeline Strainers.

Sarco engineers, ever resourceful, divided each of the two large Cherry-Burrell plate-type heat exchanger units into two separate

sections with a blank baffle plate, each with a separate Sarco control. Thermal sensing bulbs were installed in wine discharge and throttling controls hooked into steam supply. As demand fluctuates, one or both regulators function to maintain the 140° temperature. In higher demand, both regulators are operative; as demand drops and flow decreases, only one regulator supplies steam. Pasteur himself would have been elated.

Each of six smaller capacity shell-and-tube heat exchangers required only one regulator, with the sensing bulb inserted into the outlet side of the wine filled shell, and the regulator throttling steam supply to the tube section. Thus, by controlling flow of steam to the exchangers on the basis of pressure and temperature, the Sarco regulators were able to maintain the temperature of the wine at precisely 140° regardless of fluctuations in demand or supply rate. Whew! A lot of engineering went into those two sentences.

From here on it's downhill. To secure complete cut off of the steam supply during scheduled shut-downs of the bottling run, solenoid valves were provided to supplement normal modulating action of the controls. To discharge widely varying loads of condensate continuously and remove immediately all air and incondensible gases, Sarco Float Thermostatic Steam Traps were installed on all condensate outlets. On the drips before each control valve a Sarco Thermo-Dynamic Steam Trap was installed to insure delivery of dry steam. Sarco Pipeline Strainers were installed before all steam traps and valves to protect them against damage by any foreign bodies. And thus ends a classic story of the grape.

Still, this story has been condensed far too much, really, and we feel you've been cheated out of the story's more delicious details. You needn't be, however. We've printed the facts in detail for posterity and you in Sarco Case History 185, complete with drawings that practically make it a do-it-yourself kit. If you would like a copy, we will be flattered to receive your request, and dispatch it with dispatch.

WE'RE ALWAYS IN... AND THE WELCOME MAT'S OUT

We always take it for granted that if you are going to be in the vicinity of our plant you'll phone or drop us a line so we can invite you to visit us. You'll find that our factory in Bethlehem, Pennsylvania, is on many well-travelled routes, and that our steam laboratory has much to offer in interest and helpfulness. Forgive us for being immodest, but the lab is the most up-to-date of its kind in the country.

When you visit us, don't allow yourself to get sidetracked by the drill presses and automatic lathes. We're proud of this equipment but you've probably seen metal mutilated before, and it's our steam laboratory that's unique. We promise you a good show, and if you have any problems, bring them along. We'll solve them while you wait.

ANYONE FOR KEY CHAINS?

Need a key chain? A tiny replica of a Sarco Thermo-Dynamic Steam Trap, Type TD-50 is attached but you can always remove it if you find it too commercial. There are many things you could use these chains for. Fishing sinkers? Lengthening a light cord? Even holding keys? Anyway, if your Sarco representative is out, write in.

Pardon our monopolizing the conversation in this series of paid communiques, but we're trying our best to interest you in certain subjects that concern us both—to the point where you'll communicate.

6355

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

Circle 537 on postcard, page 33

NEW YD-SERIES
DOUBLE-ACTING, 10,000 P.S.I.
50, 75, 100, 150 TONS, HEAVY DUTY
BORES: 3¼", 4½", 5½", 6⅞"

NEW YDS-SERIES
DOUBLE-ACTING
10,000 P.S.I., 8, 15, 25 TONS
BORES: 1½", 2", 2½"

CENTER HOLE

NEW YDT-SERIES
DOUBLE-ACTING
10,000 P.S.I.
17, 30, 50 TONS
BORES: TWO 1½", TWO 2", TWO 2½"

CENTER HOLE

Y-SERIES
SPRING RETURN
10,000 P.S.I.
17½, 30, 50, 100 TONS

YS-SERIES
SPRING RETURN
7-9,500 P.S.I.
2, 4, 7, 10, 20, 50 TONS

New OTC 10,000 p.s.i. Hydraulic Cylinders

- PRECISION BUILT, POWERFUL, COMPACT, LIGHTWEIGHT
- THE FIRST ADVANCES FROM OTC'S NEWLY FORMED "PRECISION HYDRAULICS DIVISION"

OTC 10,000 P.S.I. hydraulic cylinders open new possibilities in "hi-pressure" designing by meeting high force requirements with compact, lightweight components. Cylinders are precision built for dependable, continuous performance. Choice of stroke length and standard or tie-rod extension mountings for YD, YDS and YDT series cylinders. Requests for quotations invited.

New two-stage and single-stage 10,000 P.S.I. hydraulic pumps and power packages also available.

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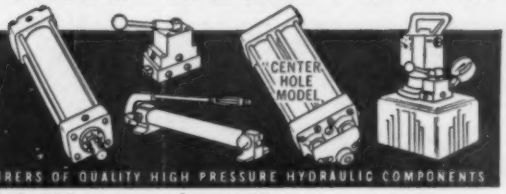
RESEARCH ENGINEERING · DEVELOPMENT OTC

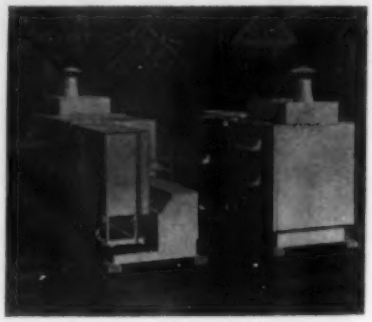


DESIGNERS AND MANUFACTURERS OF QUALITY HIGH PRESSURE HYDRAULIC COMPONENTS

Circle 538 on postcard, page 33

OPERATION—PRODUCTION

(O and P begins on page 58)



Two 7½-hp roof-mounted units solved problem of non-existent inside space for air conditioning system.

tion of the building as well as in a new extension to the engineering offices. Since these two areas had different load characteristics, the dual units made zoning possible.

Meter Measures Btu Flow

COLUMBIA Broadcasting System, New York, for the first time is able to measure exactly how much chilled water for cooling is being consumed by each of two separate CBS divisions.

This information is a prerequisite for determining how much of the cost of this service should be charged to each division and for measuring the over-all cost, per Btu ton, of chilled water in the air conditioning system.

The scope of this building management problem is more clearly understood when it is realized that the two CBS divisions are physically separate from each other. Although

This Btu meter measures cooling effect of chilled water or the heating effect of high temperature water.

Malleable Iron Liquid-Tite Connectors

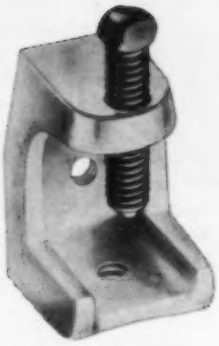
QUALITY MALLEABLE IRON FITTINGS ARE AVAILABLE!

GEDNEY'S

Complete Line is Precision-Made of Unbreakable Malleable Iron . . .

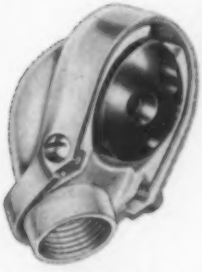
- *Unmatched for Toughness*
- *Impervious to Corrosion*

GEDNEY FITTINGS FIT



M.I. Beam Clamps

M.I. 90° Corner Adapters and Corner Elbows



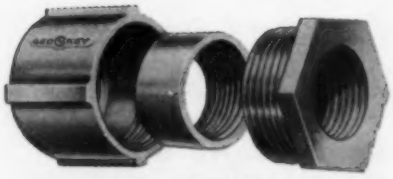
M.I. Entrance Caps

M.I. Offset Connectors and Offset Nipples

M.I. Insulated Bushings

M.I. Conduit Bodies

M.I. Armored Cable & Non Metallic Connectors



M.I. 3 Piece Conduit Couplings

Circle 539 on postcard, page 33

Check the Advantages
of Dynaclone® Dust Filters

SINCE 1924 SLY

1930's
SLY TUBE-TYPE FILTER
Dust load was concentrated at certain points, causing premature tube failure.

TODAY
SLY "ROLL-CLEAN" DYNACLONE:
Dust is spread evenly over the entire cloth area.

2 TO 3 TIMES LONGER
FILTER BAG LIFE

Three factors play a part in longer Dynaclone filter bag life — as proved on the most demanding applications. (1) Dynaclone construction and low air-velocity design insure even distribution of dust. (2) "Resist-O-Wear" bags have 3-section design for greater basic bag strength. (3) Dust is removed from bags by reverse cleaning air. No shaking — no abrasion.

There are other reasons why the "Roll-Clean" Dynaclone sets an unmatched performance pace. Flat bag design means 20 to 40% more cloth in a given space — greater capacity per cubic foot of filter. The Dynaclone is automatically self-cleaning. It operates continuously, provides constant uniform suction at dust sources for complete collection.

Check *all* the Dynaclone advantages . . . *Send for 36-Page Catalog 104.*

"Roll-Clean" Dynaclone: Patents 2,867,289, 2,938,598. "Resist-O-Wear" Filter Bags: Patent 2,959,247.

THE W. W. SLY MANUFACTURING CO.

4600 Train Avenue, • Cleveland 1, Ohio • Offices in Principal Cities • Overseas Licensees: Andrew Air Conditioning Ltd, London S. W. 1, England • Mideco Pty. Ltd., Nunawading, Victoria, Australia

Circle 540 on postcard, page 33

OPERATION—PRODUCTION

(O and P begins on page 58)

consuming chilled water from a common source, they are in different buildings of CBS' multi-building Manhattan headquarters.

The data required to determine over-all cost of air conditioning service will be obtained from a Pollux mechanical Btu meter. Although these meters are designed to measure consumption of either hot water for heating or chilled water for cooling, the meter at CBS has the sole function of measuring chilled water. With this meter, building management need only read the meter dial at regular intervals to assess proper charges.

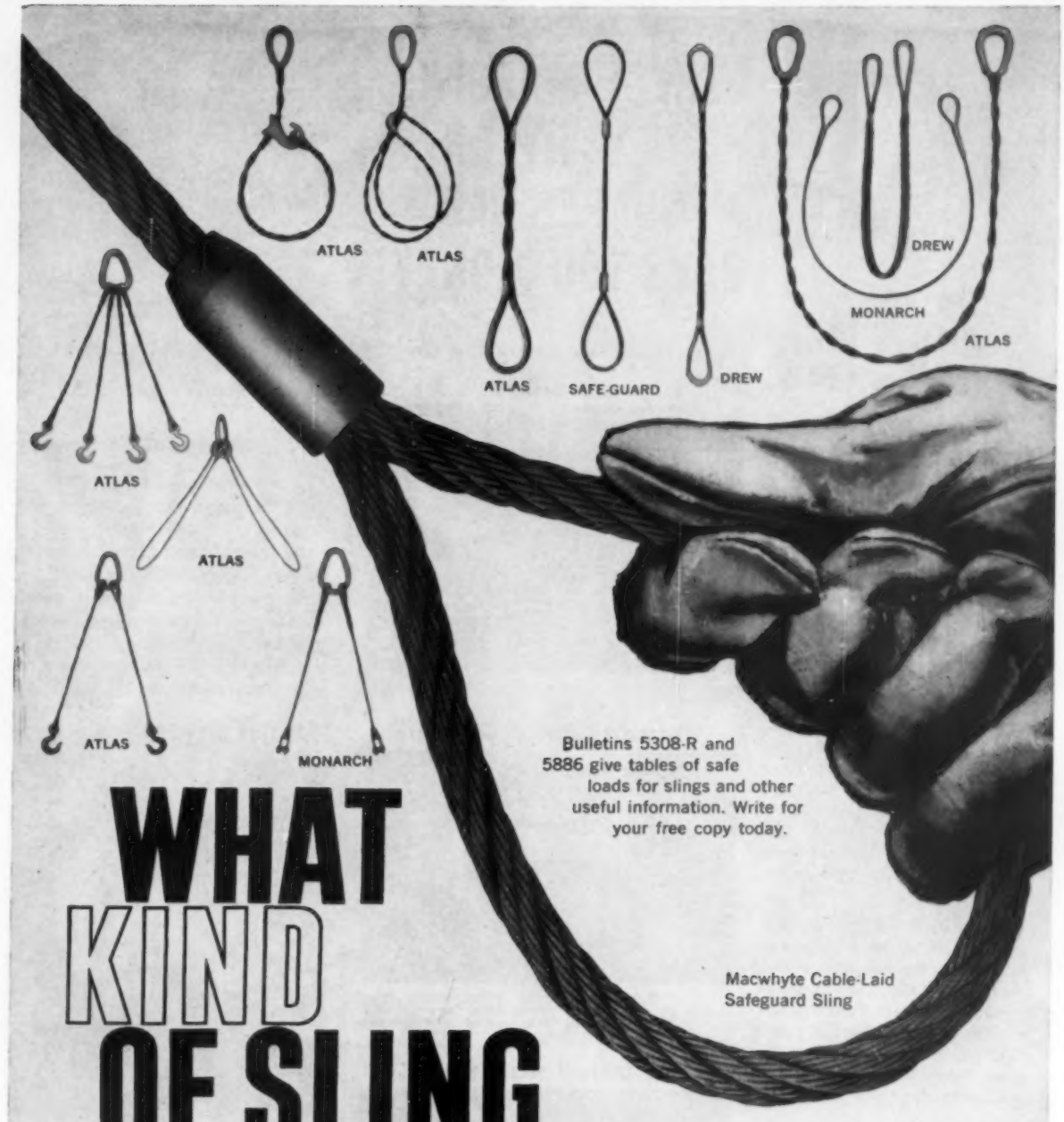
Nylon Solves Thrust Problem

THRUST WASHERS made from molybdenum-disulphide-filled-nylon were used by Wallingford Steel Co., Wallingford, Conn., to solve a

Operator points to filled nylon thrust washers that solved thrust problem.

maintenance problem on two Sendzimir rolling mills. Bronze thrust washers, previously used in roll backing assemblies, failed under compressive load and had to be replaced at frequent intervals. In addition, when the bronze thrust washers failed, adjacent parts were damaged.

To solve this problem, washers were machined from a tubular bar of Nylatron GS, a composition of molybdenum disulphide and nylon manufactured by The Polymer Corporation. These washers have been in



Bulletins 5308-R and 5886 give tables of safe loads for slings and other useful information. Write for your free copy today.

Macwhyte Cable-Laid Safeguard Sling

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GIVES YOU SAFEST, EASIEST SERVICE?

Whatever it is, Macwhyte makes it. The right Macwhyte is among hundreds of sizes and types designed for lightness, flexibility, and easy handling. Standard body styles include Atlas round-braided, Drew flat-braided, and Safe-Guard cable-laid. Special slings will be designed for your unusual load-handling conditions.

You can rely on Macwhyte distributors to give you the best wire rope and slings.

MACWHYTE WIRE ROPE COMPANY

2900 FOURTEENTH AVENUE, KENOSHA, WISCONSIN

Wire Rope Manufacturing Specialists Since 1896

345

Circle 541 on postcard, page 33

THESE MASSIVE NEW NYLON SHAPES CAN SAVE YOU MONEY!

Nylon has been proven in service as an outstanding bearing material because of built-in lubrication, ability to withstand abrasive and corrosive environments, and mechanical strength. And MC* nylon, newest of the nylon family, is more adaptable than any and most economical of all. Tubular bars, for example, cost less than other nylon formulations . . . even less than continuous cast bronze. Plate and rod sell at prices under competitive nylons.

POLYPENCO MC nylon has premium properties similar to nylon 101 with outstanding wear life, strength and resistance to deformation under load. Typical applications: rollers, bearings, bushings, gears, cams, forming devices, wear plates, tooling and general structural wear parts.

AVAILABILITIES

TUBULAR BAR: 2"-15" O.D.
SOLID ROD: 3"-24" O.D.
LARGE PLATE: ¼"-6" Thick

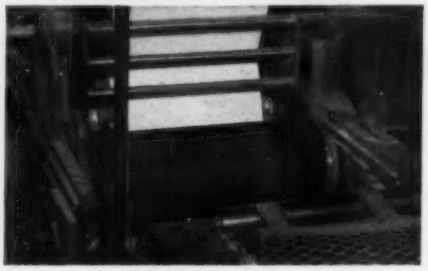
SPECIAL SIZES AND SHAPES ON REQUEST

*Trademark of The Polymer Corporation

IN BUSHINGS

Non-scarring work holder bushings for disc grinding roller bearings.

IN BACK-UP ROLLS



5" I.D. x 7" O.D. x 13" long back-up rolls for die cutting outline and patterns of paper place mats and lace doilies save $2000 per machine in cost of rolls alone replacing Kraft paper rolls.

IN DRIVE ROLLERS

Support rollers for end grinding roller bearings.

THE POLYMER CORPORATION OF PENNSYLVANIA
Reading, Pennsylvania
Engineered Industrial Plastics
EXPORT: Polypenco, Inc., Reading, Pa.

STOCK SHAPES • MOLDING RESINS • SINTERED PARTS • WHIRLCLAD® COATINGS

Circle 542 on postcard, page 33

OPERATION—PRODUCTION

(O and P begins on page 58)

service for over four years without a failure.

Rigidity and strength of the filled nylon prevents distortion and fracture under compression. Routine maintenance inspections of the washers show they are free of fatigue cracks and deformation. Low coefficient of friction of the filled nylon against steel assures cool running and prevents heat buildup between the washers and steel bearings.

Water Strips Plaster Molds Fast

REMOVING PLASTER of paris molds from cast aluminum patterns is a tough but delicate cleaning job. The Valentine Match Plate Company, Dayton, Ohio, licked this problem and saved over 800 man-hours a month by cleaning the castings with a high pressure water spray. Producing up to 500 castings per month, the company reduced the time for the cleaning operation from about two hours to less than 20 minutes.

High pressure blast of water softens and cools molds and strips plaster from castings in less than 20 minutes.

Previously, it used to take one man the better part of a day to clean the castings. Large pieces were broken off with a plastic mallet, then using a garden hose and soft wooden probes, the workman had to dig out and wash away all the plaster material from the intricate crevices in the pattern.

Now with the high pressure Aquablast washer, furnished by John Bean Division of Food Machinery and

Depth of line...depth of service!

You get the full benefit of the full line every time you choose Black & Decker . . . over 130 power tools, *thousands* of B&D Accessories for everything from drilling to grinding, cutting to cleaning. They're all powered to make better time, cut costs quicker . . . built to stay on the job longer, handle the job easier.

Your Black & Decker distributor has them all. And he offers you complete service, too. Dealing with your distributor cuts your costs by holding down paper work, saving transportation costs, keeping down inventories . . . gives you fast catalog and price information, immediate service on adjustments and complaints . . . centralizes your buying and gives you superior credit facilities. Black & Decker Tools are sold by leading distributors everywhere. *For sales or service, look in the Yellow Pages of your telephone book under* TOOLS ELECTRIC

Black & Decker

CUTS MAN-HOURS TO MINUTES

Circle 543 on postcard, page 33

THE BLACK & DECKER MFG. CO., Dept. 0807
Towson 4, Md. (In Canada: Brockville, Ont.)

☐ Please arrange for a demonstration of.....

☐ Please send me more information on .....

Name..... Title.....

Company.....

Address.....

City..... Zone.... State.....

☐ Drills ☐ Hammers ☐ Vacuum Cleaners ☐ Belt Sanders

"What have you done about this DUST?"

In our plant trouble is spelled D-U-S-T. And our plastics production V.P. wanted to know what I had done to get rid of it. He was mad, and frankly, I didn't blame him. Dust was costing us a lot of money each year—in machine wear, misalignment and down time—to say nothing about absenteeism and poor morale among the workers. How could the plant help but be dusty—with grinders, lathes, milling and molding machines running 16 hours a day.

But I explained that I had checked on several dust control systems. The problem was that in 6 months we planned to expand and re-model the shop. It seemed like throwing good money after bad to invest in a control system now. But the V.P. wanted action. He told me about a Torit engineer who had called on him claiming he had a dust control system that offered complete *flexibility.* Then he gave me his card and suggested I call him immediately.

Believe me, I called that Torit man, but fast. He explained to me the flexibility his system offered—how with just minor changes it could be adapted to the new plant layout. I bought one of his Torit Model 24 Cyclone machines for less than $1,000. It services 2 molding machines, a double-end grinder, 2 lathes and a milling machine. And it really performs—has practically eliminated the dust in our shop. We're finishing our expansion and I have ordered another Torit Dust Collector to service our additional machines. You'd hardly recognize our shop now. It's clean. Production is up—morale is up—absenteeism is lower than ever.

Cyclone Model 24

Torit can solve your dust problems. For complete facts on dust . . . and how to control it . . . write

TORIT manufacturing company

1133 Rankin St., St. Paul 16, Minn., Dept. 1832

Circle 544 on postcard, page 33

OPERATION—PRODUCTION

(O and P begins on page 58)

Chemical Corporation, molds are stripped off the aluminum castings in less than 20 minutes. To eliminate the whitewash splashed from the high pressure stream, Valentine has built a spray room in which the molds and castings are placed during washing.

While the cleaning is being done, a continuous water spray is trained on the windows to keep them clear of the whitewash. The operator places the gun through a port and adjusts it to the fog spray position to soften and cool the mold. Then he sets the gun to full 600 psi pressure to strip away every bit of the plaster.

Graphite Boosts Heater Output

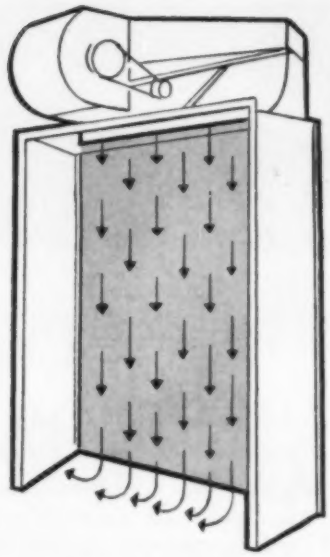
COATING the bottoms of small electric water heaters at Payne Products Company, Ann Arbor, Michigan, is increasing the efficiency of operation an estimated five to eight per cent. The black graphite coating, 'dag' 154, supplied by Acheson Colloids Company retains up to 80 per cent of the radiant heat normally lost in the operation of a hot water heater.

Diluted in the proportion of one part of the coating to five parts isopropanol, the black graphite is applied to the concave bottoms of the tanks with a brush. Temperature of the water heating elements run between 1100 and 1200 F. The water tank itself heats to 400 F when dry and to between 160 and 170 F when full of 140 F water.

Graphite coating applied to bottom of water heater saves 80 per cent of heat.

AIR ISOLATOR*

***opens** doorways to unlimited traffic*



Air Isolator is available for openings up to 8′ wide, 10′ high.

Traffic speeds through "open" door as Air Isolator immobilizes movement of air between the two areas.

***screens out** heat, cold, humidity, dust, odors, insects*

• AIR ISOLATOR is the proven and practical answer to high volume traffic problems between two areas of different temperature or humidity.

AIR ISOLATOR provides a high velocity curtain of vertical air across open doorways to form a shield between outside and inside air. During periods of heavy traffic, doors can be opened and left open. Traffic moves faster; dust, cold, heat, odors or insects are repelled; worker comfort is assured.

* registered trademark and product of Lehigh, Inc.

WRITE FOR INFORMATION

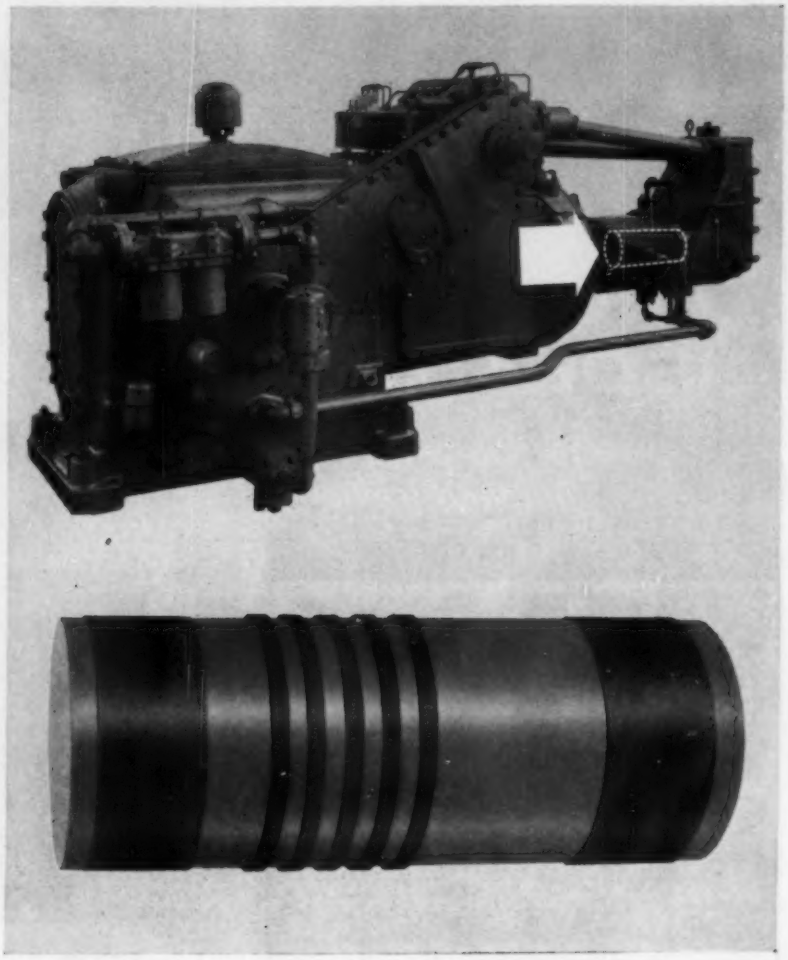
Complete data on the economical Air Isolator is yours for the asking. Write today to Jamison Cold Storage Door Co., Hagerstown, Md.

JAMISON

COLD STORAGE DOORS

Circle 545 on postcard, page 33

Cooper-Bessemer applies Garlock Teflon* Piston and Rider Rings (bottom, to prevent leakage and assure proper piston support) on the Type FXA expander engine (top). In a special closed-loop test, the engine is evaluated over a wide range of conditions in the process of air liquefaction.



NEW ENGINEERED TEFLON PISTON RINGS for Non-Lubricated Service

Cooper-Bessemer chooses Garlock Teflon Piston and Rider Rings for severe duty on their new FXA expander engine. Against pounding 2000 p.s.i. pressures, and at temperatures that dip to an icy −270°F, the Teflon rings seal tight without lubrication on the power piston of an expander engine that provides various gases at cyrogenic temperatures, while harnessing power at the same time.

Cooper-Bessemer is optimistic about the new Garlock Teflon Piston and Rider Rings. Since inception of the Type FXA gaseous expander engine, the rings have performed with negligible wear, and have eliminated the most undesirable hazard in an oxygen plant—contamination of the gas either from lubrication or from the ring materials themselves. Teflon Piston and Rider Rings need absolutely no lubrication and are unaffected by—and do not affect—gases, chemicals, and most other process materials.

The first really satisfactory rings for non-lubricated service, Garlock Teflon Piston and Rider Rings will not crack or break, will not score cylinder walls, and are flexible for easy installation . . . withstand temperatures from −420°F to +500°F; available in carbon-filled or glass-filled Teflon in either butt joint, step joint, scarf cut or solid.

On this application, Cooper-Bessemer also applies rod packing rings and scraper rings—more of the complete line of high-quality Garlock metal packings. If you have a sealing problem, ask your Garlock representative for assistance. Call him at the nearest of the 26 sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-178. Garlock Inc., Palmyra, N. Y.

Canadian Div.: Garlock of Canada Ltd. **Plastics Div.:** United States Gasket Company. **Order from the complete line** of quality Garlock products . . . Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Shapes and Parts.

*Du Pont Trademark

GARLOCK

Circle 546 on postcard, page 33

This is AMERICAN OIL COMPANY

Our organization has more than 70 years' experience in the oil business. We are one of the largest petroleum organizations in America.

We believe the experienced American Oil representative who calls on you, plus the products and facilities which he has at his disposal, are reasons why you will like to do business with us.

Your American Oil representative receives special training for his job at our Sales Engineering School. He is given concentrated basic instruction in all phases of petroleum product quality and application. According to a planned schedule, he returns for an advanced course and then again for post-graduate work.

In our Marketing Technical Service Department are specialists who are recognized authorities in their fields. These senior consultants may be called in to work with you on any specialized problem.

More than 1,000 research scientists and technicians are at work in our research laboratories developing new products and finding ways to improve present products. Their mission: To help your American Oil representative help you lower your maintenance costs and stretch your maintenance dollars.

Twelve American Oil refineries give flexibility to the production of petroleum products for industry. They help make it possible to assure prompt delivery. Upwards of 2,875 miles of product pipelines augment delivery facilities.

American Oil representatives operate from 74 District Offices. Thirteen Regional Offices strategically located throughout the country lend support to District Offices. The products you need for your plant or fleet are available from more than 4,100 warehouses and distribution points. An American Oil Company representative—and American Oil products—are only a telephone call from your office. We invite you to make that phone call. Or write **American Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.**

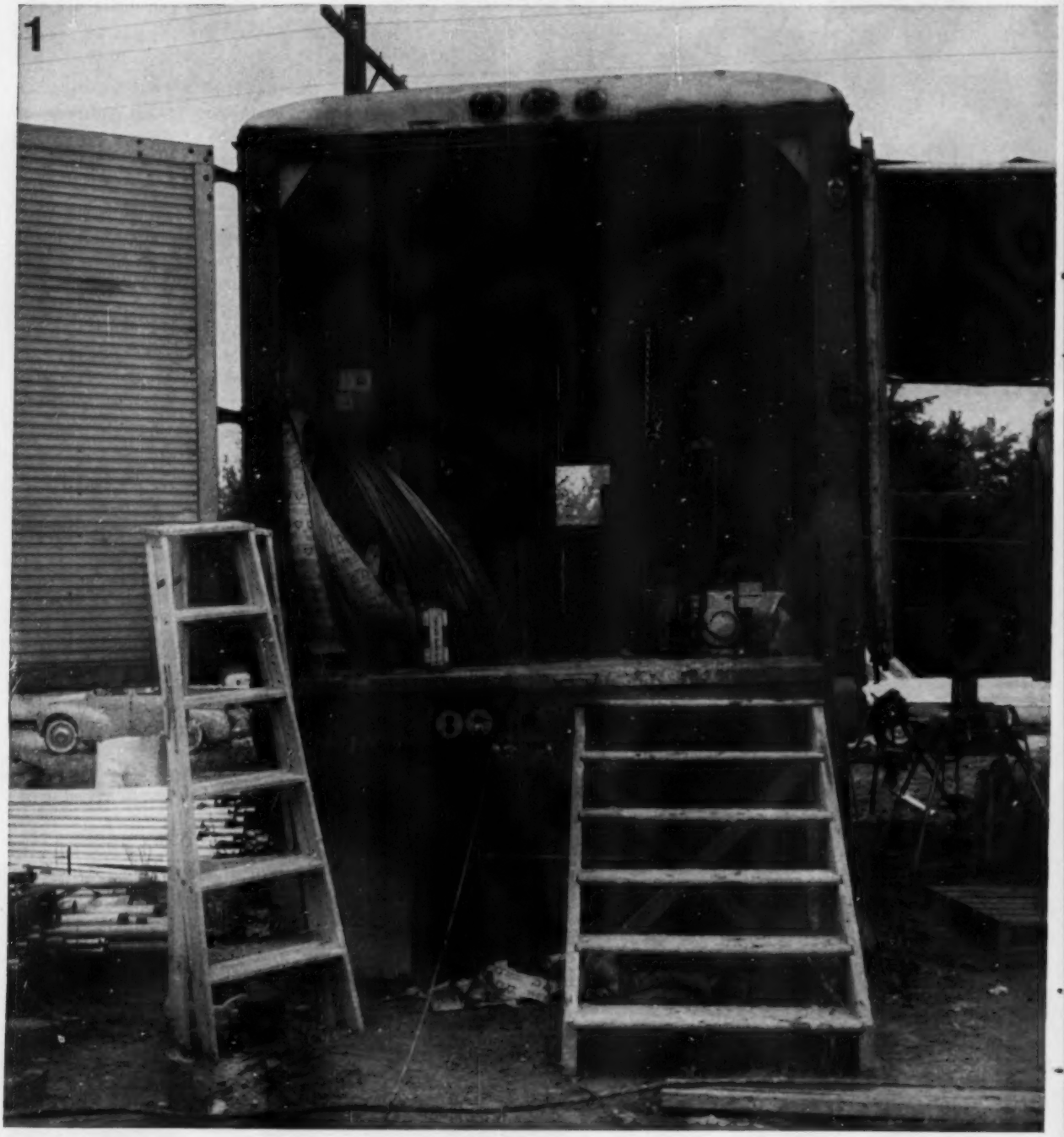
AMERICAN

AMERICAN OIL COMPANY

Circle 547 on postcard, page 33

Building new...modernizing

Nothing equals the versatility, quality and economy of Mineral Insulated Cable for jobs up to 600 volts! ☐ It's fast—MI Cable is rigid, yet so flexible electricians make even complex bends by hand, right on the job. ☐ It saves money: since MI Cable takes fewer man-hours to run—you get a better job quicker, at lower cost. ☐ It's safe—MI Cable is solid, ending problem of moisture, heat and

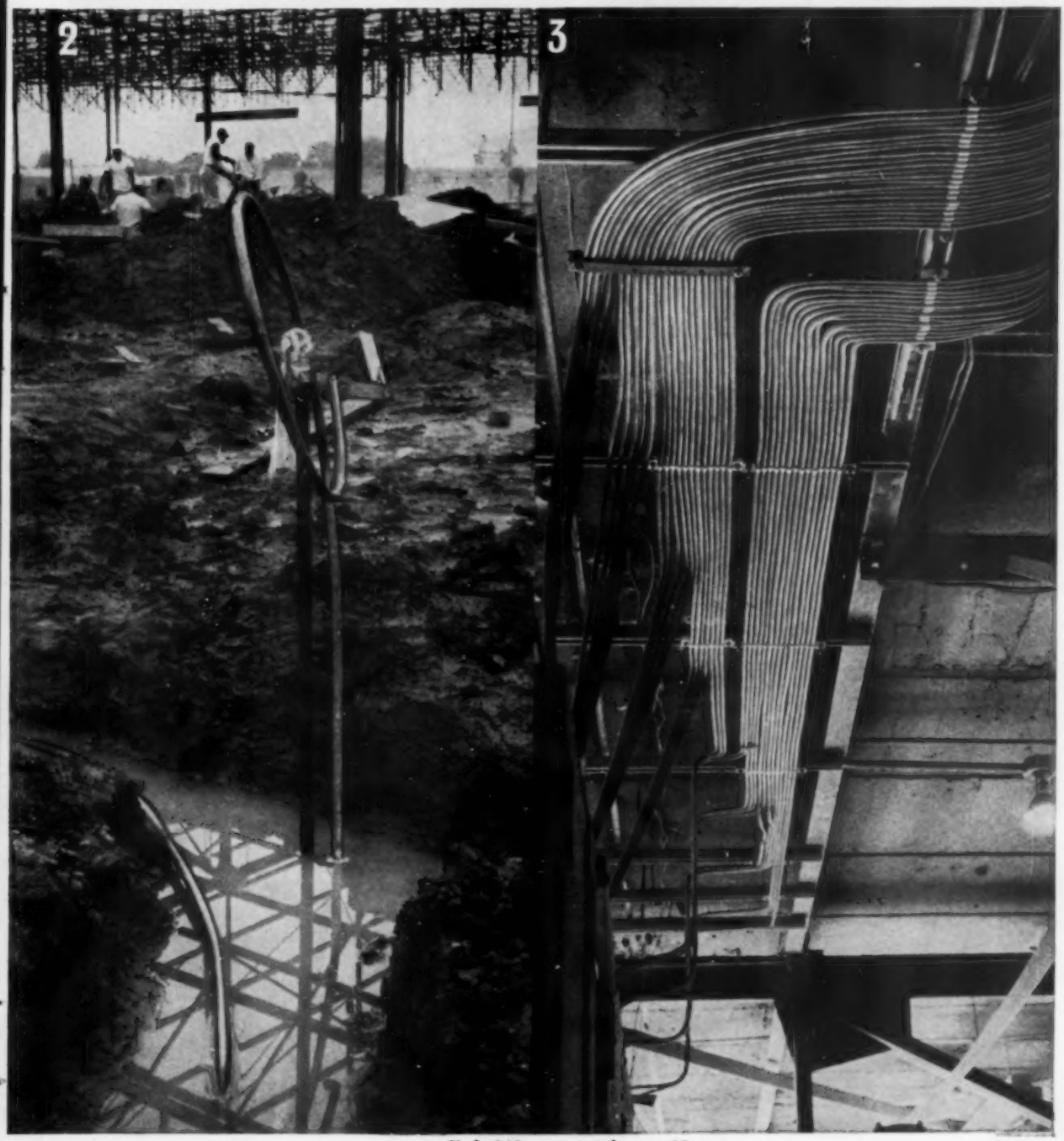


—good jobs call for MI Cable

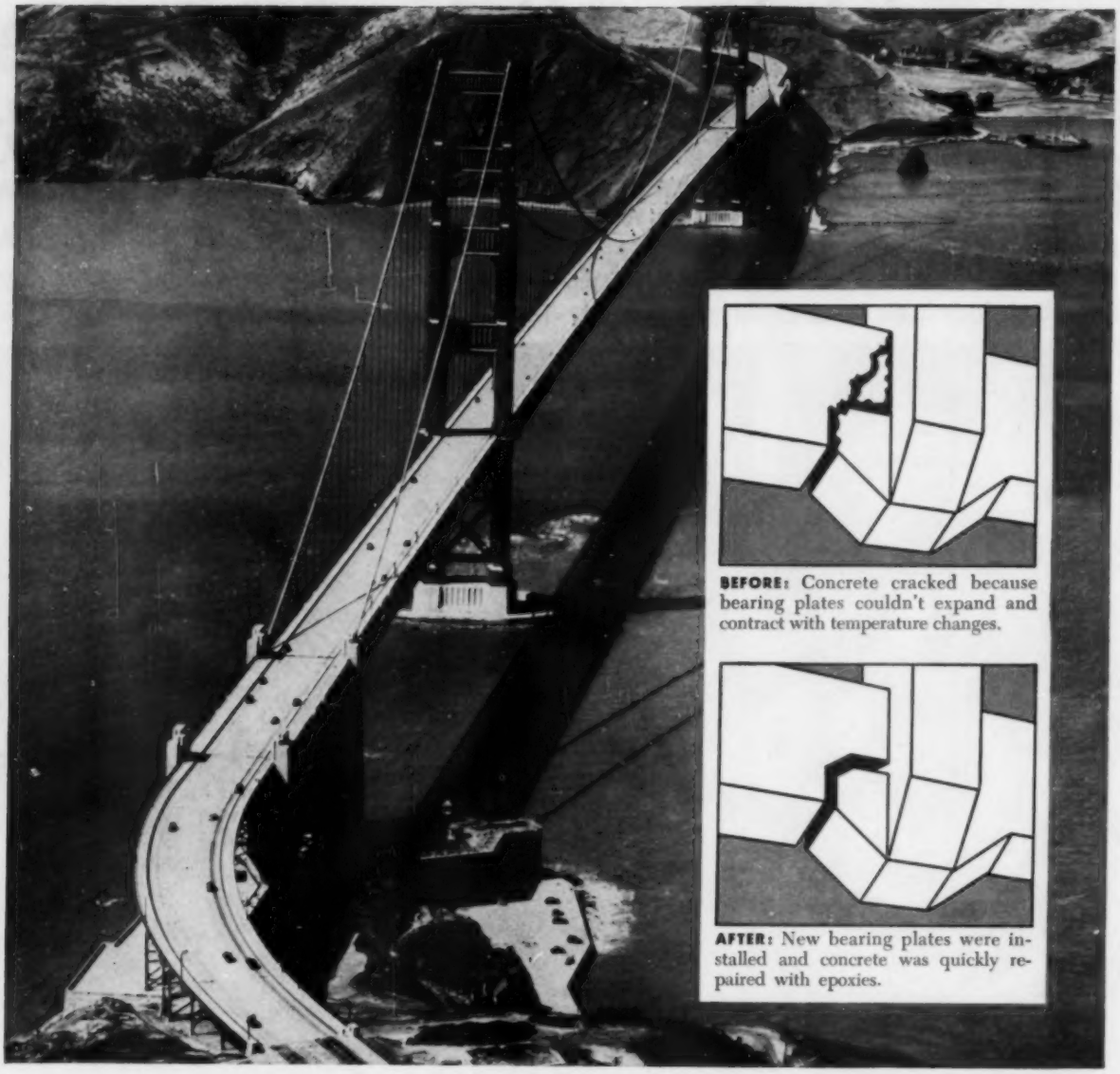
explosion. ☐ Get the full details on MI Cable. Write for Catalog S-2. General Cable Corporation, 730 Third Avenue, New York 17, N.Y.

1 Your truck is a complete convenient shop for wiring any job with MI. 2 Only MI Cable could still be in perfect shape—without special protection—after weeks of rain that stopped all other work. 3 Compact—that's MI Cable. Here, 36 separate lines leave a motor control center in rewiring a paperboard plant.

GCC
GENERAL CABLE CORPORATION



Circle 548 on postcard, page 33



BEFORE: Concrete cracked because bearing plates couldn't expand and contract with temperature changes.

AFTER: New bearing plates were installed and concrete was quickly repaired with epoxies.

Epoxies solve tough repair problem on approaches to Golden Gate Bridge

Problem: Steel bearing plates on 588 concrete piers supporting approaches to San Francisco's Golden Gate Bridge had rusted and no longer permitted expansion and contraction of bridge members caused by changing temperature. This resulted in spalling and cracking of the surrounding concrete. Required was a way to fasten new bearing plates and repair the damage to the concrete.
Solution: First, all of the old concrete around the bearing plates was chipped away. Then an epoxy compound, Epocast 25A, made by Furane Plastics, Inc. of Los Angeles, was used both as a gluing agent and as a grout in the placement of new bearing plates. This epoxy compound was also employed as a tie-coat and sealer where new concrete was bonded to old concrete.

Compounds based on BAKELITE epoxy resins—like the one used in this repair—can be brushed, sprayed or troweled with ease and speed. Because of their great strength and excellent bonding ability, they are ideal for a wide variety of industrial maintenance applications. Perhaps they are the solution to some of your repair problems.

Want more information? Contact your nearest supplier of BAKELITE epoxy compounds. Or write Dept. JX-100G, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y.

UNION CARBIDE

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

Circle 549 on postcard, page 33

POWER EFFICIENCY!

FRANK ADAM ELECTRICAL EQUIPMENT

THE STANDARD PRODUCTS CO., FT. LAUDERDALE, FLA.

Adequate power under perfect control, where it's wanted, when it's wanted, means top operating efficiency—one of the contributing factors to Standard Products' fast and profitable growth. It was simply good business then, that Frank Adam Busduct, Panel boards and Switches were selected for its new 1½-acre plant.

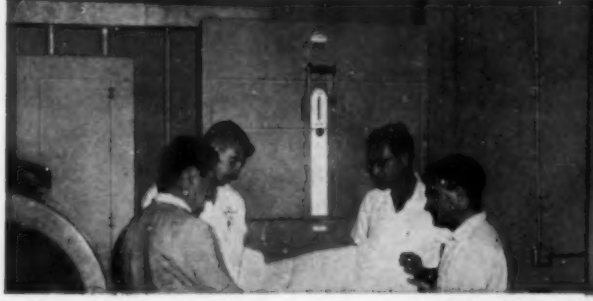
For any industrial plant where economical and dependable power, safely distributed, helps keep output and profits high, insist on the industry' finest—Frank Adam Electrical Equipment—engineered and built "for keeps!

FRANK ADAM ELECTRIC COMPANY

SINCE 1891

P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

busduct • panelboards • switchboards • service equipment
safety switches • load centers • Quikheter



The Standard Products Co., under the direction of divisional manager R. E. Burgess, precision machines exotic metal components used in rockets and missiles; manufactures specialized machined and equipment requiring certified welding and load testing. Other U. S. and Canadian divisions are major producers of automotive locks, linkages, window channel and weatherstrip.

Photo at top: l. to r., Les Summerall of Graybar Electric Co.; Vic Lanford, Frank Adam sales engineer and Tom Hackshaw of Hughes Electric Co., electrical contractor, both of Ft. Lauderdale.

Photo at left: l. to r., Les Summerall; Don Vanderlinde of Wm. VanderLinde, Inc., general contractor; Vic Lanford, and Tom Hackshaw.

Circle 550 on postcard, page 33

New way to save big when you build big

...NEW BUTLER MRF BUILDINGS

Interior Williams and Company, Inc.

•

Interior Vitro-Tech Corp., Hearne, Texas

The age of industrial monuments is ended. Buildings today are engineered to capital conservation and inevitable obsolescence. With these considerations in mind, we invite you to investigate the new Butler MRF building system—the building system that supports management aims and objectives.

Precision factory-fabricated to give you quality control in every detail. Spacious interiors with a minimum of strategically placed columns. Modules of 40′, 50′, 60′ or 80 feet. Bay lengths of 20′, 24′, 30′ or 40 feet. Roof spans up to 240 feet without internal gutters. A metal roof deck so good we can guarantee the roof 20 years, without any maintenance obligation on your part. Three beautiful, factory-colored wall systems of outstanding quality—two of them, factory insulated.

MRF goes up at astonishing speed. Expansion is easy and economical. Even the wall systems can be interchanged. In an MRF you can afford to change your mind. Quality for quality, this is economical construction, with the advantages of custom planning.

Phone your Butler Builder for the full story. He's listed in the Yellow Pages under "Buildings" or "Steel Buildings." Ask about financing, too. Or write direct.

Williams and Company, Inc., Cincinnati, Ohio • Consulting Architects / Schauder and Martin, Toledo

Alton Box and Board Co., Highland, Illinois

CELEBRATING 60 YEARS
BUTLER
FABRICATING METALS

BUTLER MANUFACTURING COMPANY

7529 EAST 13TH STREET, KANSAS CITY 26, MISSOURI

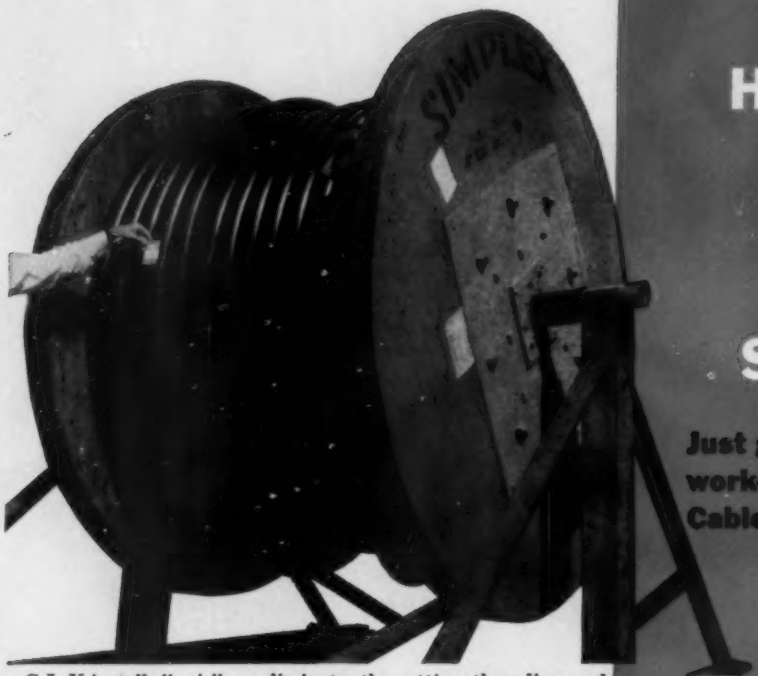
Manufacturers of Metal Buildings • Plastic Panels • Equipment for Farming, Transportation, Bulk Storage, Outdoor Advertising • Contract Manufacturing

Sales offices in Los Angeles and Richmond, Calif. • Houston, Tex. • Birmingham, Ala. • Kansas City, Mo. • Minneapolis, Minn. • Chicago, Ill. Detroit, Mich. • Cleveland, Ohio • New York City and Syracuse, N. Y. • Washington, D. C. • Burlington, Ontario, Canada

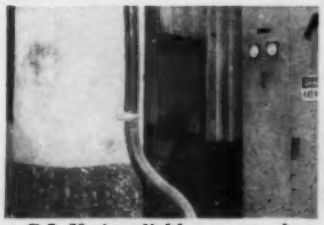
Circle 551 on postcard, page 33

HOW MUCH MONEY COULD C-L-X SAVE YOU?

Just glance at these time-and-work-saving features of C-L-X Cable Systems by SIMPLEX.



C-L-X installs "as is" . . . eliminates the cutting, threading, and pulling operations necessary with conventional duct or conduit.

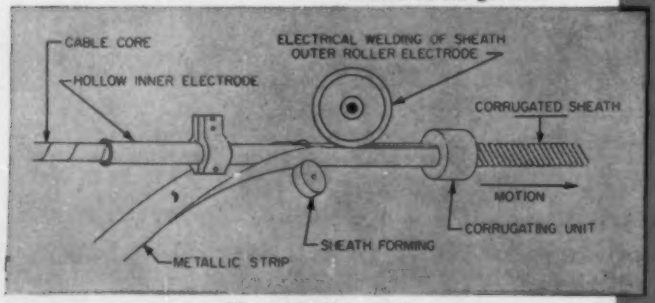


C-L-X is pliable . . . can be handled smoothly on a standard size reel.

C-L-X is easily trained anywhere, in continuous, long-length runs.

C-L-X installs without the need for benders, sand, elbows, or similar fittings.

C-L-X is versatile. It can be installed with clamps, in trays or ladders, or directly buried in the ground.



How C-L-X is made.

You'll see how easily this packaged *combination* of cable and pliable, impervious metallic sheath installs. You'll see why it cuts installation cost to a fraction of that required for conventional cable and duct. Then *find out* how much money today's easiest-to-install cable system can save you.

C-L-X is available with plastic-jacketed sheaths of steel and with sheaths of aluminum, bronze, or copper — with or without plastic jacket. It's the choice of chemical plants, oil refineries, paper mills, utilities, industrial plants — wherever severe environmental conditions exist. Write today for your free, illustrated brochure on C-L-X.

Simplex
WIRE & CABLE CO.
Cambridge, Massachusetts • Newington, N.H.

Circle 552 on postcard, page 33

COURT DECISIONS —a summary of legal findings of interest to the plant engineer

Prepared by Albert Woodruff Gray

False Statement of Quantity

SURPLUS FITTINGS and parts described in a printed sales list were purchased by a manufacturing and sales company and resold to a motor products dealer for $7500 with a copy of this printed list as a statement of the packaged merchandise.

Referring to this purchase, 95 separate kegs containing approximately 200,000 separate parts, which would take two weeks to count, the seller asked the buyer if he wished to make a more detailed inspection, to which the buyer replied, "No, if it's here as per list." To this the seller had replied, "That is right. That is what you bought. Here is the list." Assured by that statement, the purchaser paid the agreed price. Later examination disclosed that the fittings so delivered were only about 30 per cent of those detailed in the list.

The buyer brought action against the seller for what it alleged was a false statement of the quantity of these kegs.

In its judgment against the seller, the Federal Court of Appeals said of the defense, "The purchased material was packed in more than 95 separate kegs, all but a few of which contained about 200,000 separate pieces which took about two weeks to tally.

"In addition the buyer was influenced and persuaded not to inspect by the assurance of the seller in the conversation. In these circumstances an implied warranty was not negatived by the buyer's failure to inspect." Court brief 279 Fed. 2d 904, Ill., June 27, 1960.

Price Discrimination

CHARGES OF price discrimination were made by a wholesale distributor of gasoline against a refiner in which treble damages were sought under the provision of anti-monopoly laws.

By these laws it is provided, "It shall be unlawful for any person engaged in commerce, in the course of such commerce, either directly or indirectly, to discriminate in price between different purchasers of commodities of like grade and quality where either or any of the purchases involved in such discrimination are in commerce, where such commodities are sold for consumption or resale within the United States and where the effect of such discrimination may be substantially to lessen competition or tend to create a monopoly in any line of commerce, or to injure, destroy or prevent competition with any person who either grants or knowingly receives the benefit of such discrimination or with customers of either of them."

In the suit brought by the distributor, it was charged that the refiner had discriminated in price to a gasoline distributor in Manhattan and the Bronx and one in Brooklyn.

The court held that no violation of this statute had occurred. "A supplier," said the court in its decision, "may discriminate in price between a retailer customer and consumer customer, giving a lower price to the latter where the retailer would not have been able to compete with the supplier for the business of that consumer customer were he to have been afforded equal price treatment." Court brief 187 F.S. 345, New York, September 13, 1960.

Employment Contract Fraudulent

IN SEEKING the services of a dealer in air conditioning and heating parts, tools and equipment, a regional manager assured him that the sales volume of two preceding distributors for a twelve-month period exceeded a million and a quarter dollars.

Actually the sales volume of these distributors had been approximately half the amount represented by this manager. In awarding damages to this distributor, the federal court said,

"The distributorship was a red ink proposition and substantial losses ensued. Therefore, the equipment dealer abandoned the distributorship and liquidated its inventory which the air equipment dealer refused to take back. Over a year after this agreement had been made the dealer learned that the sales volume figure had been false." Court brief 285 Fed. 2d 903, Illinois February 3, 1961.

Price on Date of Shipment

CONTRACTS MADE BY a manufacturer of automobile tires and tubes with two automotive chain stores provided that prices should be those "prevailing on date of shipment."

For nine years the manufacturer sold its tires and tubes to these stores under this agreement. Then at the end of that period the contracts were modified, limited to two and three years respectively, each containing this same pricing clause. At the end of two years a further modification was made by adding a scale of rebates in both instances, giving to each of these purchasers a maximum of seven and a half per cent on the purchase price on a graduated scale.

Four months later another modification of the pricing scale was made of this provision for "prices prevailing on date of shipment," to the contract of one of these stores which allowed a price reduction of 10 per cent, that was not granted to the other.

Suit was later brought by the less favored customer for an interpretation of this contract modification which, it was claimed by this objecting customer, entitled it to the same price as was charged the other store under this pricing clause.

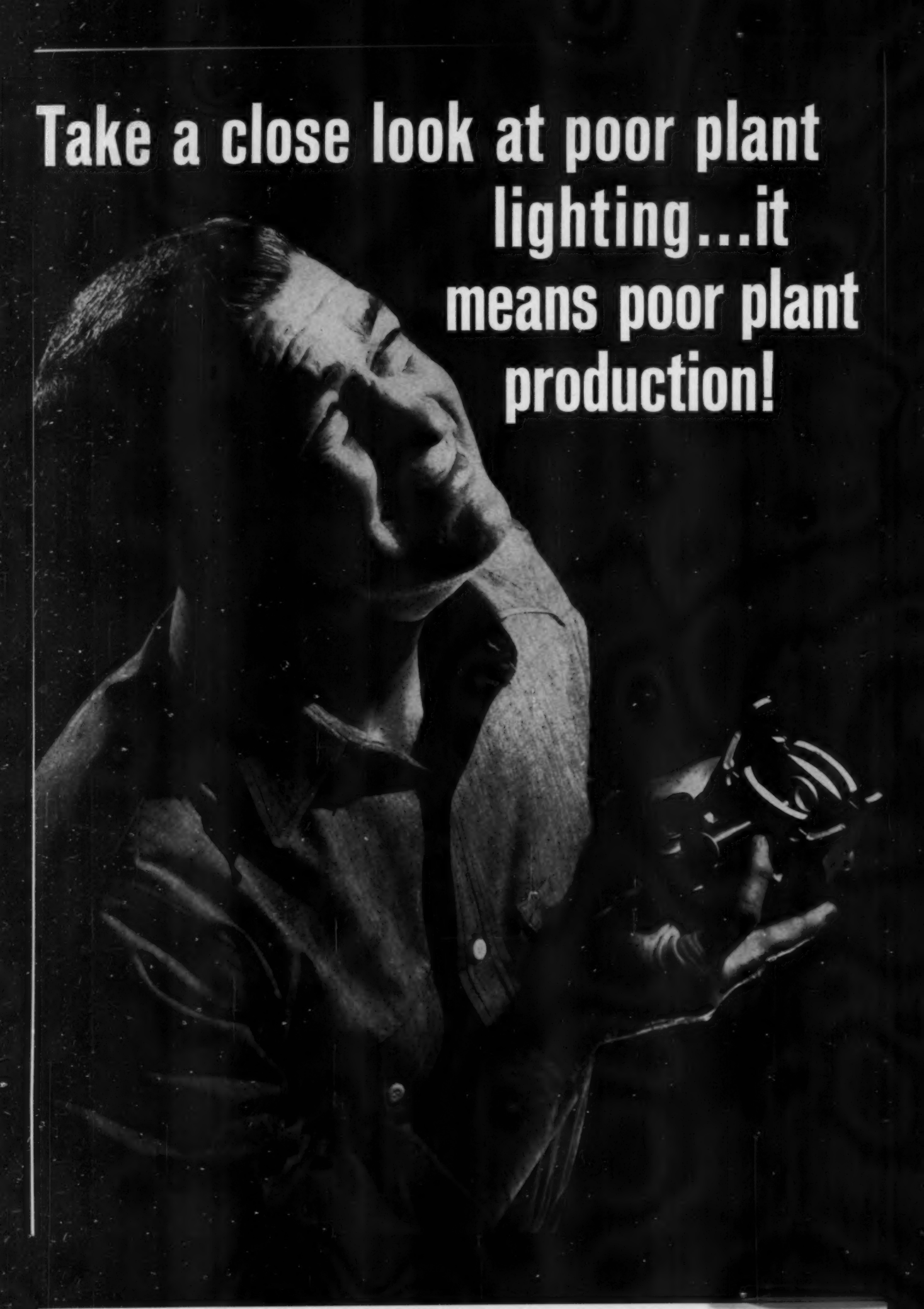
Under this clause, common to both contracts, basing prices on those prevailing on date of shipment, it would be illogical, asserted the court, to hold that the seller could charge one of two customers a lower price than it did the other for the same products. There could be but one prevailing price at a given time which would fairly be the lowest price for the goods which the seller gives to either of these customers. Court brief 279 Fed. 2d 289, Ohio, June 6, 1960.

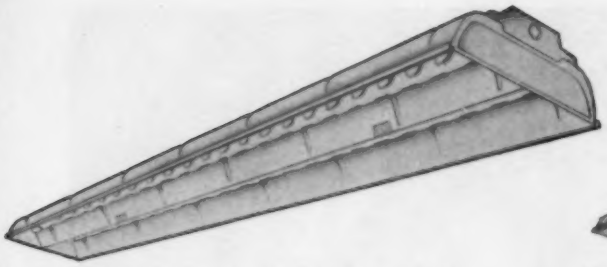
Employee Defrauded

AS AN INDUCEMENT for accepting a position, a salesman was promised "an ownership interest in the company as soon as the business he would secure for it would warrant doing so." He was given a drawing account with commissions on his sales.

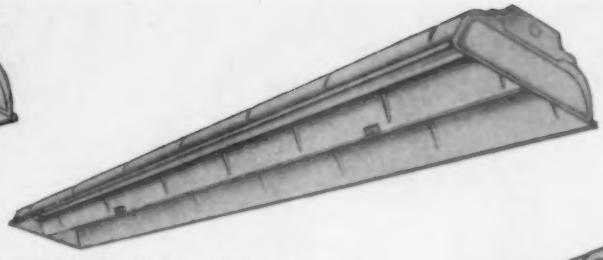
Six years later he received 30 shares of stock and two years after that an additional 30 shares. After 15 years he discovered the stock was not as it had been represented to him and practically worthless. He sued for damages, claiming fraudulent misrepresentation.

Holding that the employee could not recover on these facts, the court stated that if the employee expected to rely on the absence of value in the stock issued to him he should have clearly stated those facts. "Facts," said the court, "causing injury of the sort claimed here, must be clearly set out and furnish the means of determining the measure of interest in the corporation which the stock was intended to represent." Court brief 207 N.Y.S. 2d 293, September 16, 1960.


Take a close look at poor plant lighting...it means poor plant production!



CFI-30—Center "Vee" louver gives crosswise shielding of Power Groove lamps. 30% upward lighting.



CFI-25—Excellent visual comfort and economy. For Slimline and Rapid-Start lamps. 25% upward lighting.

Boost output with Day-Brite "Comfort For Industry" Lighting

- Increases visual acuity
- Minimizes glare
- Quickens reflexes
- Prevents accidents
- Increases profits

You can offset rising labor costs and ease today's profit squeeze by meeting currently recommended illumination levels with Day-Brite Comfort For Industry Lighting.

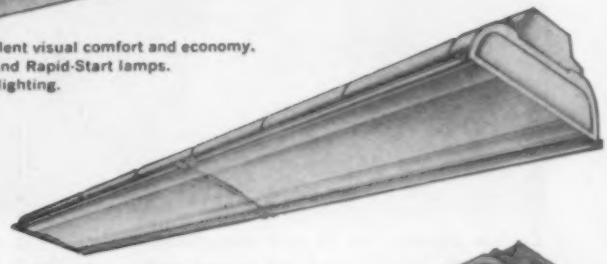
The well-shielded construction of Day-Brite CFI® fixtures reduces glare to a minimum, while upward lighting components cheerfully brighten ceilings and wipe out harsh contrasts. Easier seeing, higher employee morale increase individual output and over-all plant efficiency.

Day-Brite CFI fixtures also cost you less to install, less to maintain . . . due to factory pre-assembly, self-cleaning design, rigid construction and one-man servicing. Phone your Day-Brite representative for details. *Day-Brite Lighting, Inc., St. Louis, Mo., and Santa Clara, Calif. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ont.*

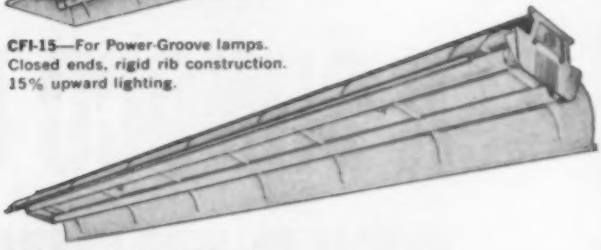
Write for FREE 16-page **Guide to Modernization and Relighting:** Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.

DAY-BRITE

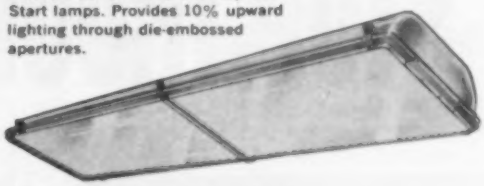
NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT



CFI-20—Power-Groove lamps with minimum glare. Cleartex® bottom panel reduces reflection from shiny work surfaces. 23% upward lighting.

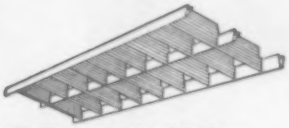


CFI-15—For Power-Groove lamps. Closed ends, rigid rib construction. 15% upward lighting.



CFI-10—For Slimline and Rapid-Start lamps. Provides 10% upward lighting through die-embossed apertures.

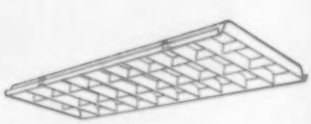
VAPOR-TIGHT—Use where fixtures are exposed to moisture or where non-combustible dust is present. Vinyl gaskated frame. Uses Rapid-Start lamps.



RS-240-TT—For Rapid-Start lamps. Economy . . . with quality features.

HINGED ALZAK ALUMINUM PARALOUVERS®
Provide the ultimate in visual comfort. Use with CFI-25 and CFI-30 fixtures.

PARALOUVER PATENT NOS. 26833799 AND 507841



HINGED LOUVERS
(Baked white finish)
Use for critical seeing tasks requiring additional shielding, with CFI-10, CFI-15, CFI-25 or CFI-30 fixtures.

Circle 553 on postcard, page 33

Carbon building up in your compressors? Here's why one of the many Sun Solnus oils can be your answer. The valve on the left is from a three-stage Norwalk horizontal-type compressor after 3,000 hours operation with a well-known high grade oil. At the right is the same valve after being torn down and examined after a 3,000 hour run with a Sun Solnus oil. Note the difference in carbon deposits! *Solnus oils form very little carbon . . . and what does form is so soft and fluffy it can be blown away.*

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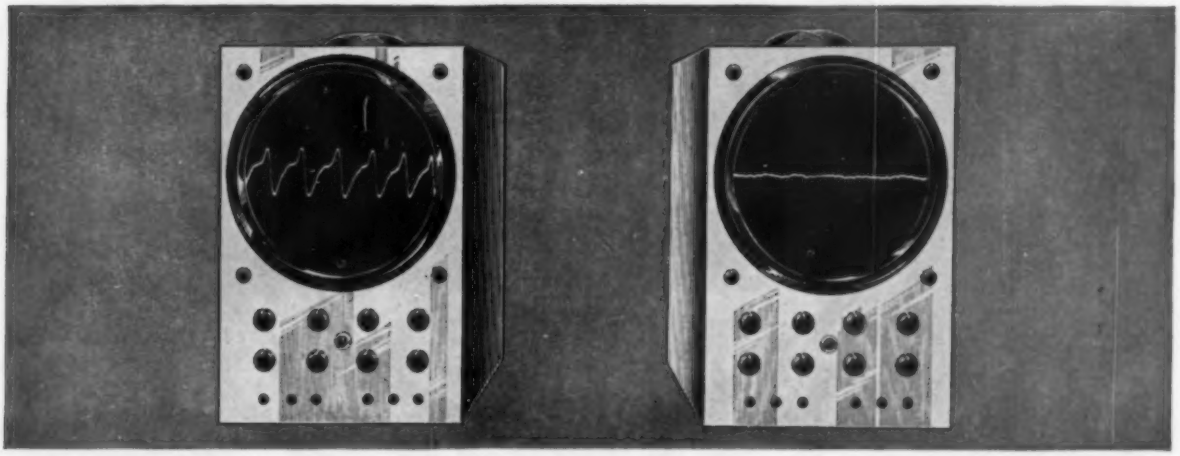
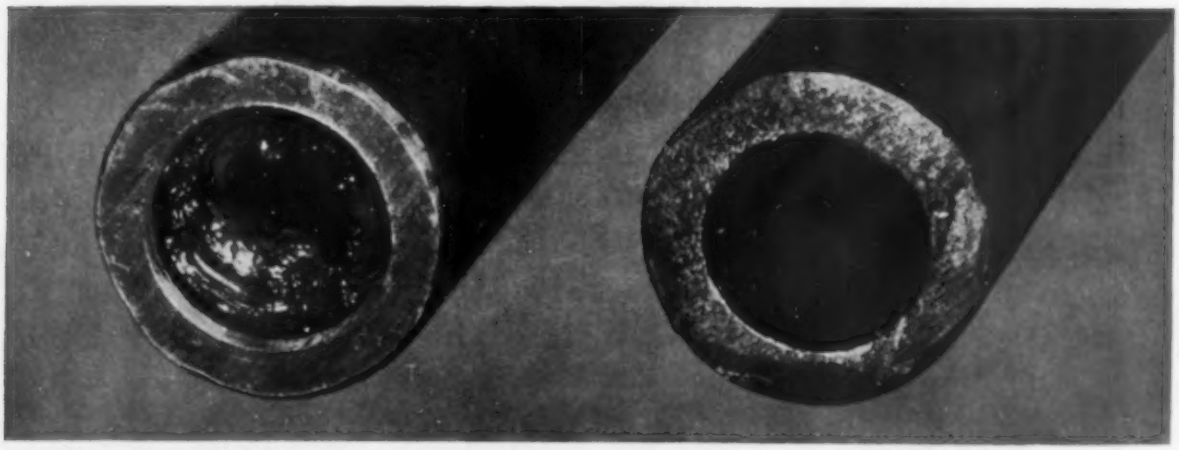
The reason is as simple as this. There are over 400 Sunoco petroleum products for industry. *Each* has the properties needed to do its job right. *Each* is job-fitted by men who know what they are doing. And *each* is backed by the service you have a right to expect. The examples on these pages will give you an idea of what we mean by Sunoco quality . . . and how quickly that quality can pay off in your applications. Call your Sunoco representative today for a hand on any problem with any petroleum product you are using. Or write to:

SUN OIL COMPANY, PHILADELPHIA 3, PA., DEPT. PY–7
In Canada: Sun Oil Company Limited, Toronto and Montreal

Hydraulic oils chewing up your O-rings, packings? The O-ring on the left was soaked in a Sun Solnus oil for 70 hours at 300F and is still as pliable as when new. The O-ring at the right was soaked in another hydraulic oil for equal time. It snapped like a match stick when flexed, for many hydraulic oils extract plasticizers from seals turning them brittle, creating leakage, replacement problems. Besides keeping rings flexible, Solnus oil restores pliability to unbroken rings already in service.

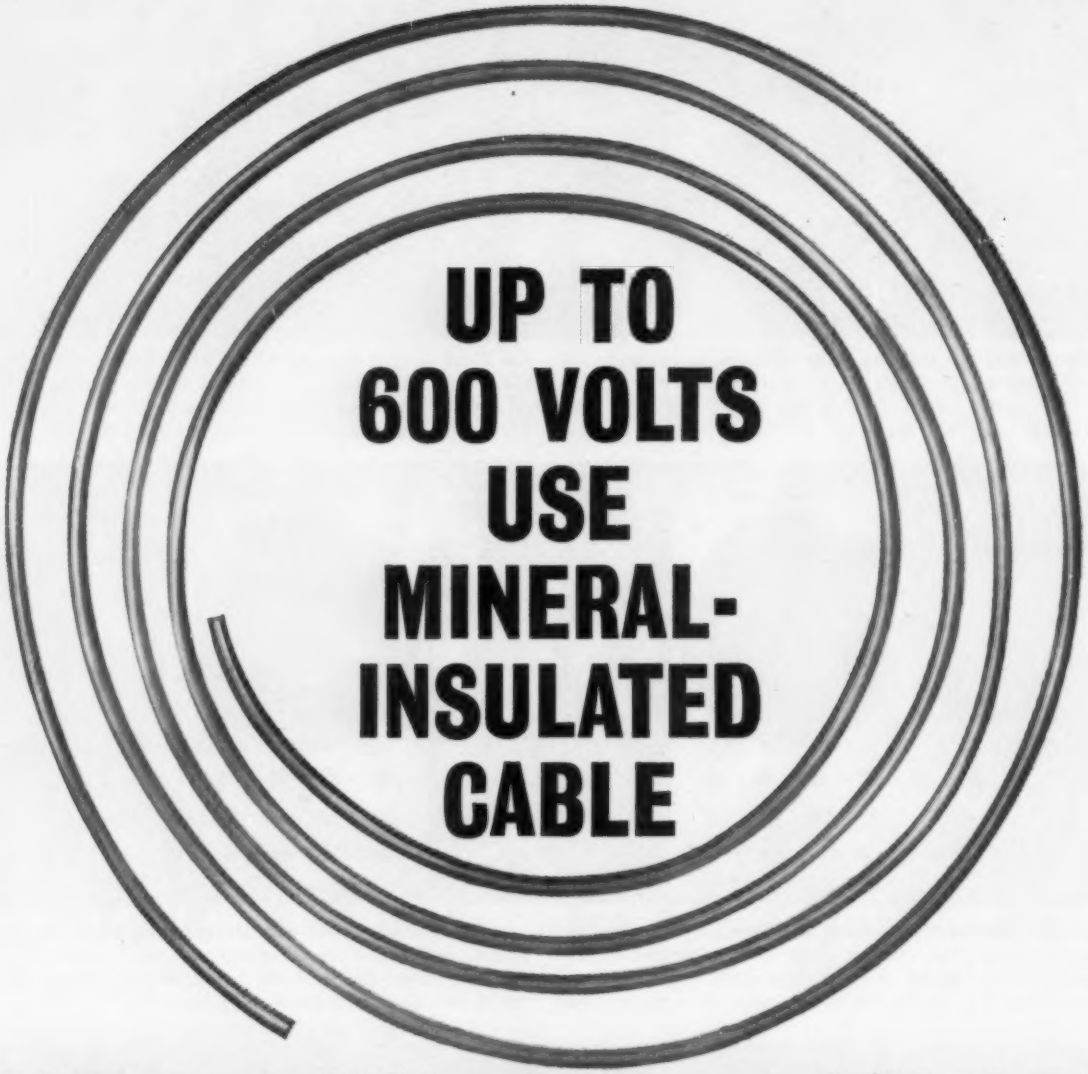


Slip-stick table motion ruining fine work pieces? These are magnified oscillogram patterns of slip-stick table motion. The jagged pattern on the left resulted when regular way oil was used on the ways; the straight line on the right, when Sunoco Way Lubricant was used under identical operating conditions. Here is graphic evidence of how effectively you can stop slip-stick table motion, protect the ways, get better surface finishes, and cut production losses with job-fitted Sunoco Way Lubricant.

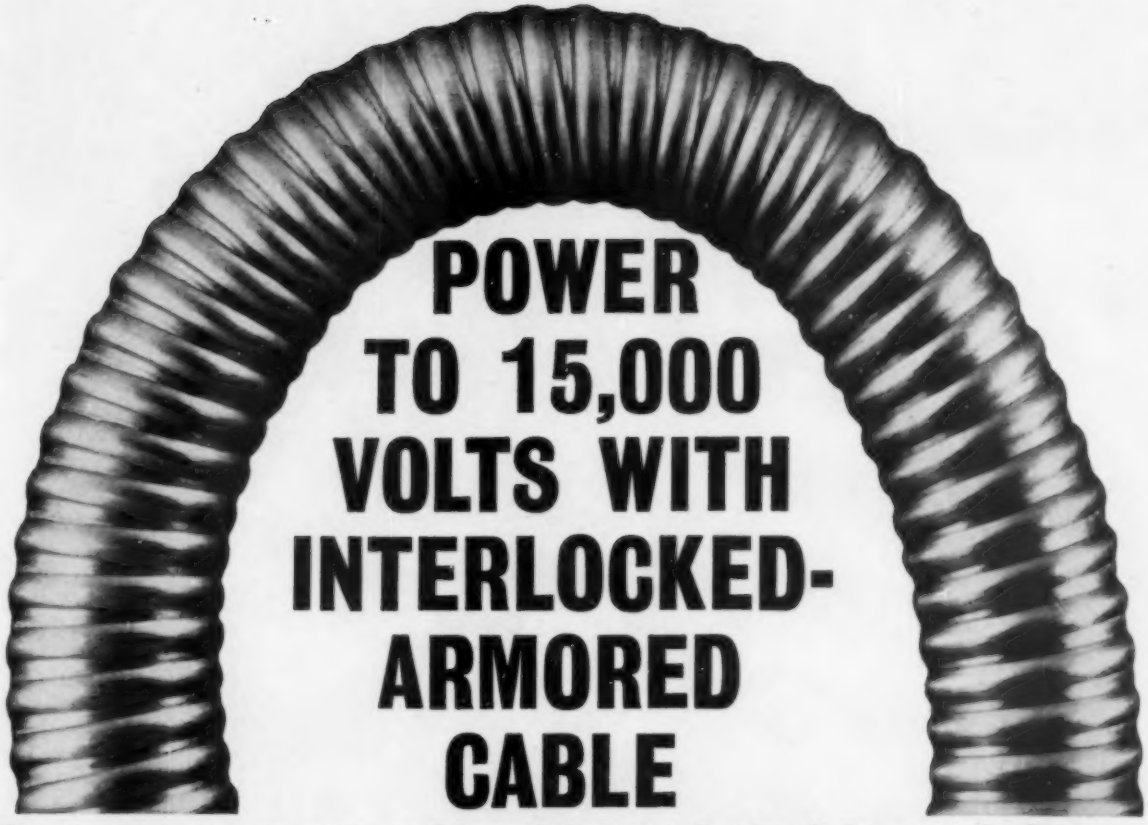


Hydraulic lines gunked up? The fouled up line at the left was cleaned out in no time when a Sunvis 700 hydraulic oil was used in the system! These oils are especially made to keep contaminants in suspension, flush them away to the filters while transmitting power. They are so effective that a single charge of a Sunvis 700 oil can keep even a continuously contaminated system running smoothly for months, often *years*. Check your Sunoco representative for a job-fitted Sunvis oil for your systems.

Circle 554 on postcard, page 33



MI Cable, too, is flexible and needs no conduit for installation. MI's conductors are insulated with refactory mineral insulation, and protected by a seamless gas tight, liquid tight copper sheath. There's no danger from moisture, vapor, or heat with MI! ■ An MI Cable job goes in fast, yet meets the highest possible standards of safety and long life. For up-to-600-volt jobs, you can't beat MI Cable.



Protect your power cable with Interlocked-Armor, indoors or out... for any above ground installation. Interlocked-Armored Cable is flexible and the contractor installs it without conduit or pullboxes. For service up to 15,000 volts—specify General Cable Interlocked-Armored Cable.

■ Be sure you get quality, economy and flexibility in your cable installations. Have your electrician or contractor specify Interlocked-Armored and MI Cable by General Cable Corporation, 730 Third Avenue, New York 17, N.Y.

GCC
GENERAL CABLE CORPORATION

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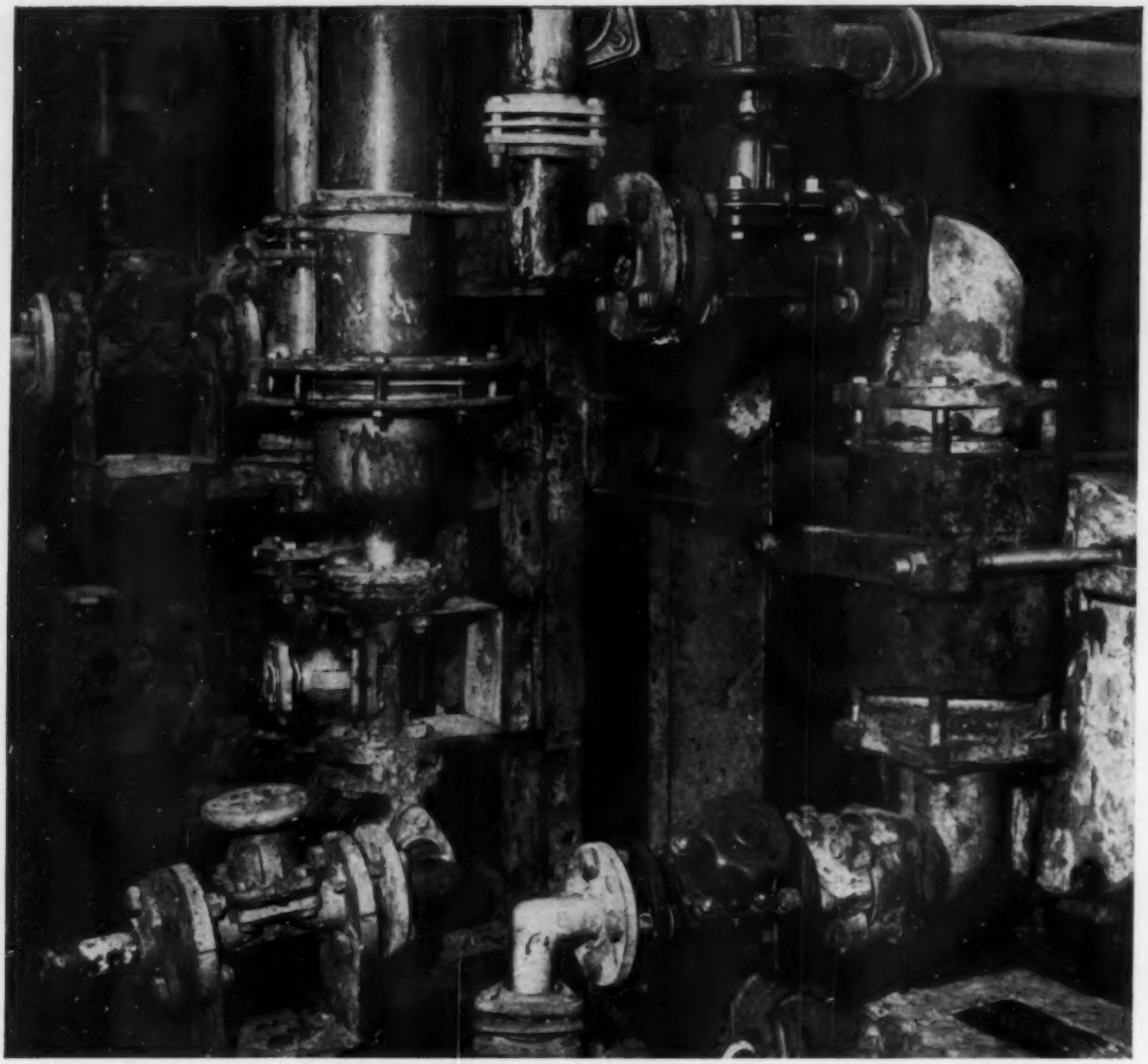


Encrustation on two of the above valves was cleaned off to show lack of external corrosion. Compare this with the corroded condition of the structural steel.

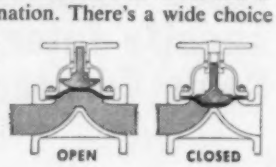
Grinnell-Saunders Diaphragm Valves resist attack by hot corrosives at Carborundum Metals Company

During the past few years, Carborundum Metals Company, a Division of the Carborundum Company, has installed over 200 Grinnell-Saunders Diaphragm Valves at their Parkersburg plant in West Virginia. These valves were coated internally and externally with Penton * —and were equipped with fluorinated plastic diaphragms, backed with elastomer cushions. Their job: to handle highly corrosive caustic soda and sodium hypochlorite–at 212°F, and methyl isobutyl ketone, hydrochloric acid, sulphuric acid at 130°F–all used in processing zirconium ore for zirconium and its co-product, Hafnium.

Today, this manufacturer reports that after being in operation an average of two years, the rugged Grinnell-Saunders Diaphragm Valves are still giving good service. What's more, they've never had to replace parts in these Grinnell Valves!

In Grinnell-Saunders Valves, the diaphragm lifts high for streamline flow – seals *tight* for positive closure. Working mechanism is completely isolated from material in the line to prevent corrosion and contamination. There's a wide choice of body, lining and diaphragm materials, too. See how Grinnell-Saunders Diaphragm Valves can help *your* installation.

Write Grinnell Company, Providence 1, Rhode Island.



* *Reg. T.M., Hercules Powder Co.*

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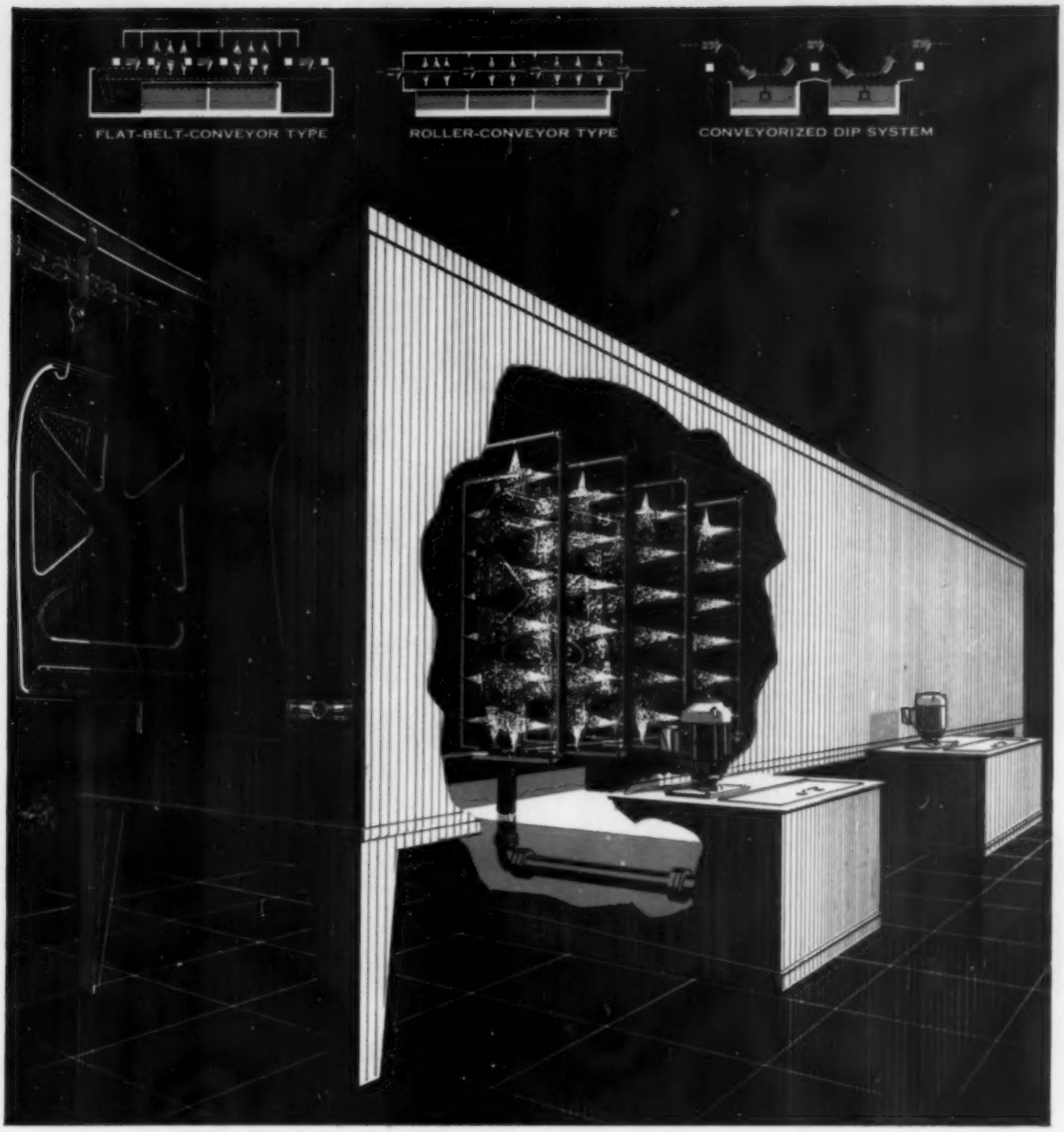

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THE DeVILBISS COMPANY, Toledo 1, Ohio. Also Barrie, Ontario; London, England; São Paulo, Brazil. Branch offices in principal cities.

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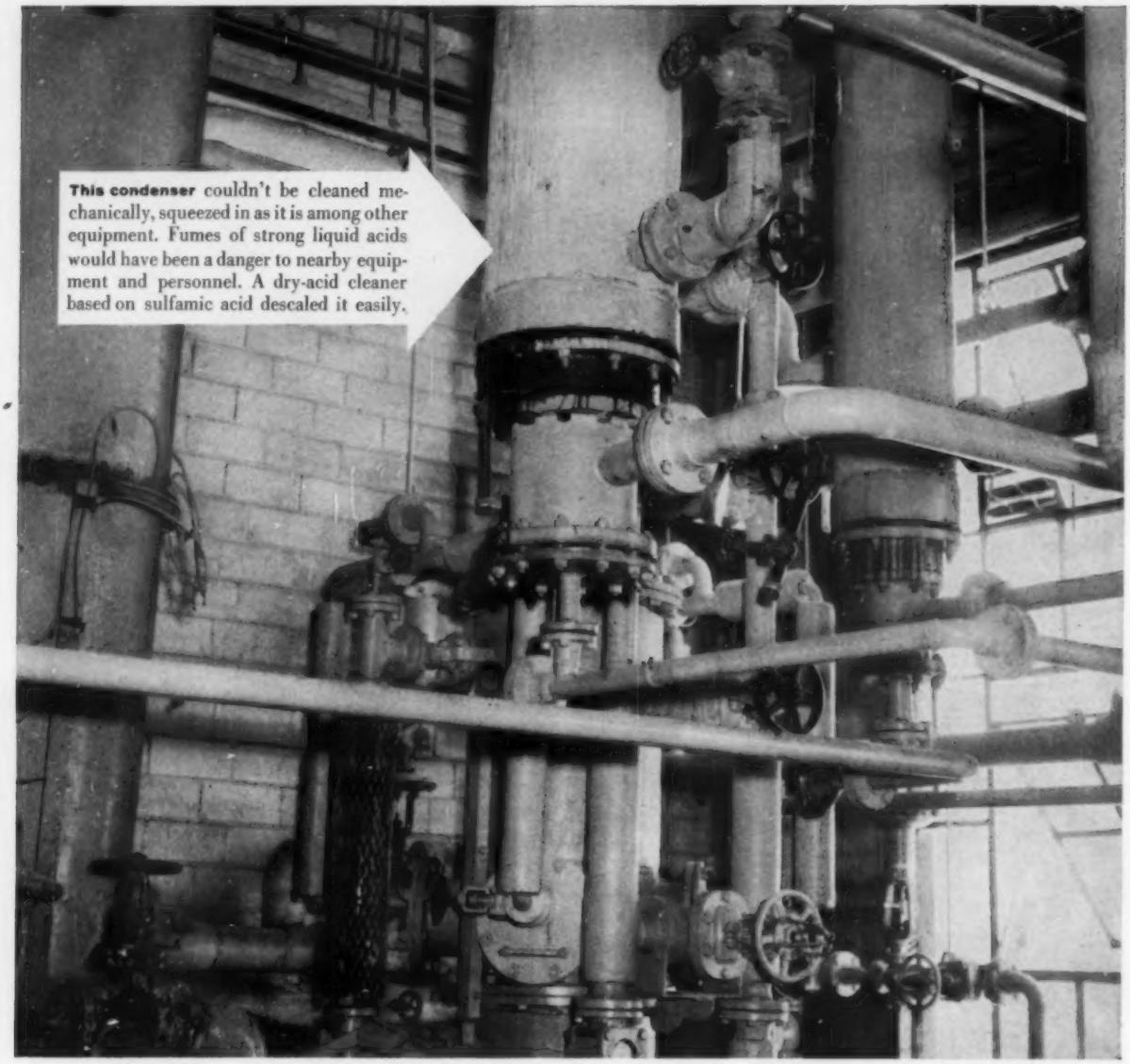
This condenser couldn't be cleaned mechanically, squeezed in as it is among other equipment. Fumes of strong liquid acids would have been a danger to nearby equipment and personnel. A dry-acid cleaner based on sulfamic acid descaled it easily.

Descale equipment in place safely, easily with Dry-Acid Cleaners based on Du Pont Sulfamic Acid

Routine descaling of even the most hard-to-get-at equipment is now possible with dry-acid cleaners based on Du Pont Sulfamic Acid. You cut downtime drastically, because there's no need to dismantle or protect surrounding equipment from corrosive fumes.

Just dissolve these dry-acid cleaners in water and they're ready to remove even the most stubborn scale and deposits—often the solid granules can be added directly to the equipment. Yet dry-acid cleaners are far less corrosive to metal than hydrochloric acid. And the operation is so safe the only protective clothing needed is goggles; elaborate apparatus and specially trained personnel are unnecessary.

Dry-acid cleaners based on Du Pont Sulfamic Acid are available everywhere. If you'll mail the coupon, we'll send a list of suppliers and more information.

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Please send your "Quick Facts on Dry Cleaners" booklet and names of formulators offering cleaners based on sulfamic acid.

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*Company*_____

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*City*_____ *State*_____

Circle 558 on postcard, page 33

PLANT ENGINEERS SHOULD BE KEPT IN THE DARK

While we feel that plant engineers are pretty nice people and wholly trustworthy it is obvious now that, in the opinion of some other nice people, they are not to be trusted with information that would permit them to write directly to a manufacturer.

We have just examined a copy of a new "service" to plant engineering and maintenance. It is a listing of new products and is called "Significant Ideas and Devices—Manufacturing and Maintenance." It is published by Purchase Engineering Associates, Ambler, Pa. (The price, incidentally, is $4.95 for 48 mimeographed pages, 36 pages bound in one volume and the remaining 12 in a second volume).

However, for the plant engineer this is not exactly a "tell-all" service. The ideas and products are described in Volume I, the plant engineer's volume. But the names of the manufacturers of the products are listed in Volume II which is, the publisher says, ". . . to be kept in the purchasing department . . ."

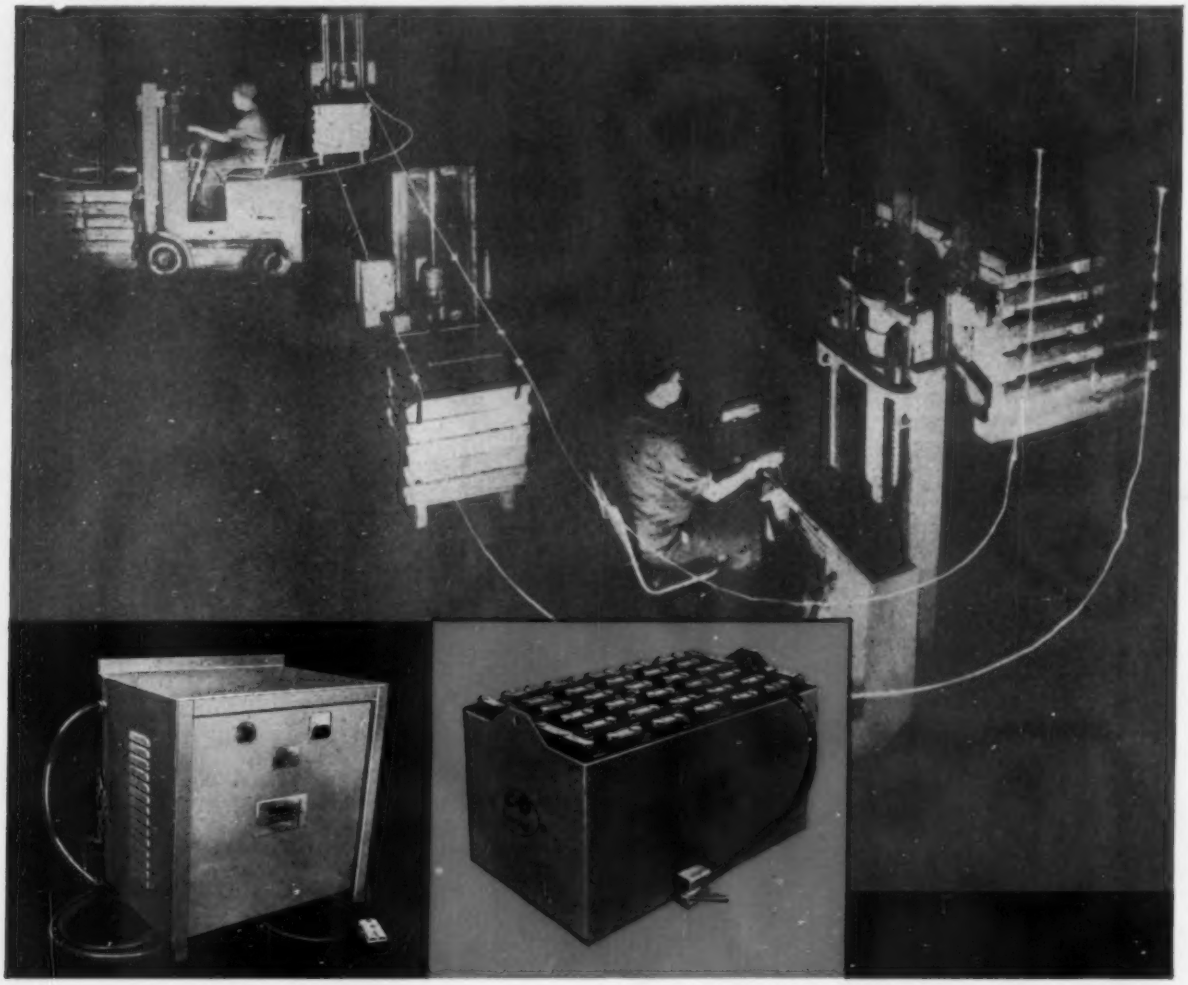
Now, purchasing agents are probably nice people, too, even though some of them are a bit formal and standoffish. They are not, most likely, in favor of applying a complete set of blinders to the plant engineering department in order to emasculate its authority to specify engineered products. At least we don't think they are. But it might be a good idea, in case you should be given a copy of Volume I of the above service, to check up on the location of Volume II. It's a good bet it will be found in the purchasing department.

Tom Hanson

productivity

When you power the best in trucks, electric—with the best in batteries—C & D Slyver-Clad you get productivity in materials handling. ■ Electric trucks are easier to maneuver; run smoother, inch at a touch, start and stop on a dime. Investigate and you'll find they cost less to own, run and maintain. ■ C & D Sylver-Clad batteries are the finest power package available for any electric truck. Five separate layers of insulation and retention keep active materials in place. Life shortening, sediment build-up is virtually eliminated. A C & D exclusive, Hi-Impac cell containers and covers, greatly reduce breakage of these elements. ■ C & D AutoReg charges with Slyver-Clad batteries complete the perfect power team. Auto-Regs are highly efficient, simple to operate and have no relays to adjust. Operation does not require trained personnel. A unique charging circuit, incorporating a hermetically sealed silicon rectifier, automatically supplies the required charging current and increases battery life expectancy. Because the rectifier doesn't age, aging taps and the need for adjustments are eliminated. AutoReg chargers are ideal for any type of plant layout. They may be wall, balcony or floor mounted. Smaller models can be truck mounted. All Auto-Regs will improve the performance of any make battery. ■ Regardless of the nature of your truck fleet—hand, rider, or combination of both—you'll get greater productivity by combining Slyver-Clad batteries and AutoReg chargers. For complete details write for Auto-Reg and Slyver-Clad bulletins.

For productivity in materials handling—use high-speed electric trucks powered with C & D *Slyver-Clad*® batteries—charged by *AutoReg*®



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Circle 559 on postcard, page 33

WHAT'S JUST AHEAD IN THIS ISSUE

- PREVENTIVE MAINTENANCE programs can either boom or bust. To strengthen your chances for success, pick the right program for your plant, and manage it properly. Many helpful suggestions, as well as some 'don'ts,' are outlined in the article starting on the next page.

- A TELEVISION CAMERA, "guarding" a remote gate, helps keep constant check on plant entrances and exits. By reducing the guard force, the TV equipment is saving its owners $15,000 a year. For a complete description of the unit and its application, turn to page 98.

- COMPRESSOR LUBRICANTS, properly selected and applied can provide many hours of trouble-free operation. Lubricant and lubrication recommendations for different types of compressors are outlined in the article "Lubrication Needs of Compressors" which starts on page 100.

- FREQUENTLY, a plant engineer needs special electrical equipment—something which cannot be bought off the shelf. When ordering such equipment it is important to set down definite specifications to insure getting the right piece of equipment for the job. In the article starting on page 104, the author suggests points to consider in setting up these specifications.

- WHAT CAUSES water hammer? What is the relation of velocity to pressure rise when flow in a pipe is interrupted? What should you do, if water hammer troubles your plant? For answers to these questions, turn to page 111.

- IF YOU HAVE EVER considered use of air starting for internal combustion engines you'll be interested in the article, "Air Starting Can Pay Off." The author details the advantages to be derived—reduced operating and maintenance costs and elimination of a safety hazard—and tells how to engineer systems for several types of engines. Turn to page 118.

- PLASTICS in rod, tape or strip form are solving bearing maintenance problems for industry. They may not be the answer to all problems, but there are many areas where they can be used. For the full story of which plastics are available and how they should be installed, read the article on page 121.

Managing a PM Program

Preventive maintenance needs good management, if it is to yield maximum results in terms of safety, plant performance and over-all cost reduction. This article shows how good management is based on choosing the right type of PM program and emphasizes the importance of starting modestly, establishing attainable objectives and progressing in well defined stages.

Successful PM management also depends on carefully building the right type of team and maintaining a close control over procedures and costs, as well as relating the activities of the group to the actual results attained. Continued success is enhanced by presenting to management and others in the organization, a regular report showing the benefits achieved by the PM program, as an essential means of securing full support and cooperation.

By **H. F. BOTTCHER** and **C. J. PRATT**, Management and Operations Services
Management Consulting Division, Ebasco Services, Inc., New York

IN MOST INSTANCES, lack of success with an apparently sound PM program can be traced to an incomplete understanding of the basic management principles involved, going right back to the time when the scheme was being developed. These principles are so simple that they tend to be ignored by busy technical men and it is well to review them carefully on the lines which follow, before setting up a new PM program, or overhauling one which somehow has become obsolete.

Good management starts with knowing beforehand what type of program is best suited to the organization. For example, some companies, especially those not primarily engaged in manufacture, lease a good deal of their equipment from others or make extensive use of maintenance contracts; hence only a modest PM plan may be justified.

In other cases, as in many process industries, maintenance operations may play such a large and costly part that every step leading to better design and performance must be explored. Consequently, the need for a comprehensive, engineered PM program may be readily apparent from an analysis of production records and an examination of excess costs.

Five principal types of PM programs are available and the following descriptions are intended as a general guide, when planning the effective management and future growth of preventive maintenance in an organization. In most cases it is a good policy to adopt PM stage by stage, on the lines of the successive programs outlined below.

1—Data Gathering and Cost Analysis

This form of PM program is restricted to compiling production figures and equipment repair data for subsequent analysis and review, but unless firm steps are taken beforehand to study thoroughly the collected information and use it, mere data-collecting will turn out to be largely a waste of time.

When properly undertaken, the program is likely to reveal cases of unsuspected obsolescence, faulty production and maintenance conceptions, and hidden excess costs. Further study will suggest suitable ways of extending this simple type of program to a more dynamic form and translating investigation into cost-saving preventive action.

Today, many plants have on file excellent machine-history and production records which only need skilled interpretation to make them the genesis of a sound preventive maintenance scheme.

2—Inspection and Reporting

Losses caused by an unexpected breakdown can be reduced if periodic inspection reports are used as a basis for integrating repair work with production.

A valuable guide to the proper degree of inspection can often be obtained from an analysis of past production and maintenance records, if these are available in a sufficiently adequate form. In the absence of accurate records, a sensible inspection pattern usually emerges after several months of operating a program of this type.

Not infrequently, this pattern will show some surprising differences when compared to the schedule initially conceived. For example, it may prove more economical to leave certain equipment out of the PM program, particularly those units of a non-critical nature.

Effective management of this type of PM program depends on:

Establishing the optimum amount of inspection necessary as regards magnitude, number and frequency.

Making maximum use of collected data, in terms of reduced production costs and, if possible, lower maintenance charges.

Proving to management the net savings achieved and preparing a strong case for more dynamic preventive maintenance.

3—Inspection, Reporting and Servicing

Most equipment needs periodic attention and even in cases where oilless bearings and components are used, some form of routine servicing is usually required, such as dust removal, safety-checking or minor adjustment. Hence it is a natural step to combine simple lubrication and/or servicing with PM inspection and reporting

schedules. Programs of this type have become popular in recent years.

In managing such a program, it must be recognized that certain limitations exist. For example, although every good machine designer strives to insure that lubrication and servicing do not interfere with the operation of the equipment, even a simple inspection may necessitate stopping the machine and removing various guards, covers and components. Furthermore, it may not always be possible to combine in one individual the dual functions of servicing and inspection, because of trade union restrictions or the need for special skill.

Of course, an astute plant engineer responsible for the management of this type of PM program can often simplify numerous inspection operations by the use of such aids as temperature-sensitive paints, sight glasses, industrial stethoscopes, more accessible test-points, extra pressure gages and other simple forms of instrumentation.

Similarly, centralized lubrication and the judicious use of oilless bearings can often reduce the cost of time and materials used in routine oiling. Naturally, both the need for inspection and any extra equipment should be justified for economic or safety reasons, otherwise the program may defeat its original purpose of reducing maintenance and production costs.

This type of program provides valuable initial experience in forward planning, work estimating and labor control, for those organizations not yet undertaking scheduled maintenance work of any kind. In addition to scheduling lubrication and servicing, prior arrangements must again be made to analyze and use the information continually furnished by the routine inspection reports, otherwise at least half of the benefits of the program will be wasted.

4—Scheduled Adjustment, Repair and/or Replacement

Many organizations are well equipped to undertake most of their own routine repairs, and may wish to include in their PM program as much of this work as can be justified. Hence a logical development of the foregoing PM plans, once sufficient background skill and knowledge have been acquired, is to introduce schedules for routine adjustments and repairs (or replacements) on a periodic basis.

Although this class of work is distinct from general maintenance, e.g. the planning and scheduling of major repairs, modifications, installations and other jobs of a long cycle or non-routine nature, the experience gained is an invaluable aid towards the ultimate goal of the progressive plant engineer—that of running the entire department on a virtually 100 per cent planned and scheduled basis.

Managing a PM program of this type demands considerable background knowledge and judgment. For one thing, the program must be flexible, since routine work of an apparently cyclical nature has an embarrassing habit of not adhering to schedule. This particularly applies to the process industries where rates of corrosion and wear often fluctuate to an unaccountable degree.

A good PM manager will learn to recognize apparently innocent or unrelated factors, e.g. changes in raw materials, products or even variations in climate, and not only will develop effective countermeasures beforehand, but will feed these observations back to engineering, research and production.

Recognition that scheduled PM is an animate plan, rather than a rigid program for routine inspection and maintenance, enables useful economies to be made. For instance, an unexpectedly low rate of corrosion or wear may enable a planned repair or replacement to be deferred, or even postponed until the next scheduled overhaul. This may result in a net saving in materials and manpower, or may offset extra work needed elsewhere, thus enabling the PM manager to stay within his allotted budget.

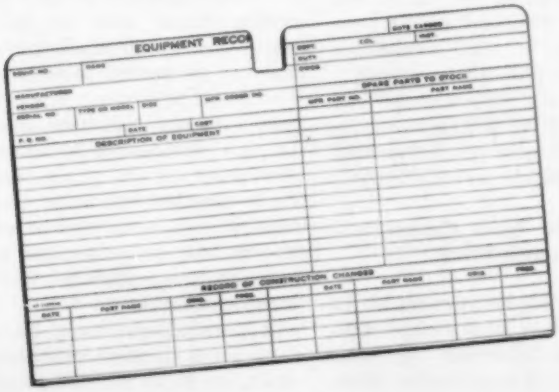
Sometimes it may be found that the useful lives of items such as bearings, clutch parts and small belt drives can be predicted with fair certainty and in some of these cases, periodic replacement may prove to be less costly than routine inspection, adjustment and repair or random breakdown. Other savings may sometimes be made by adopting periodic group replacement for items such as lamps, condenser tubes and electrical contacts, instead of relying on individual inspection, repair and renewal.

5—Engineered PM Program

An engineered PM program embodies all of the features outlined in the foregoing series, and in addition, incorporates a study group headed by the PM supervisor or manager. This study group may include such specialists as a cost accountant, an operations-research man, an industrial engineer and perhaps experts in fields such as instrumentation, materials handling or transportation, according to requirements.

Typical functions of the group include: selecting key equipment for inclusion in the PM program, developing optimum schedules, analyzing cost and statistical data and devising better ways of undertaking preventive maintenance. A major function is, of course, helping others to improve the design and operation of plants, processes and equipment by contributing specialized knowledge that will lead to reduced maintenance costs and increased production. Hence, managing this type of program places special emphasis on the ability to lead an active development team in addition to organizing and running a flexible maintenance operation.

Although a full-time PM engineering group represents an overhead that



This Equipment Record form is just one of many which may be adapted to fit your PM program.

could not readily be justified in every organization, a part-time team consisting of the plant engineer, the production manager, and the cost accountant, say, can be highly successful in discovering basic ways of reducing associated maintenance and production costs in the smaller firm.

Many medium—and large-sized—companies, especially those in the process industries, have found a fully engineered PM program to be well worthwhile in terms of lower total production costs. For example, in the automobile industry, where one minute of line shutdown may mean a loss of several thousand dollars, engineered PM is an effective insurance against production stoppages and prohibitive maintenance charges.

Similarly, engineered PM in the oil and chemical industries is an invaluable means of improving plant safety and operational efficiency, in addition to providing basic data for the development of better processes and equipment.

Start Modestly—Establish Clear Objectives

Regardless of the PM program chosen, it is a safe rule to start modestly and, as experience is gained, progress deliberately towards the desired goal. A popular way to begin is to establish a limited equipment inspection and reporting procedure in conjunction with an analysis of past production and maintenance records, in order to estimate the potential savings and to plan succeeding developments with confidence.

Even when the plant engineer or PM supervisor has had previous experience in preventive maintenance, it is unwise to launch a full-scale, plant-wide program in an organization new to PM procedures, because of the sudden rush of unfamiliar work created.

Furthermore, under these circumstances, the initial savings are likely to bear little relation to the cost of running the full scheme. This will soon draw mounting criticism from management; consequently the PM program (and also its advocates) may suddenly be faced with an uncertain future.

After the most suitable program has been selected for initial operation, it is most important to decide which plant areas and equipment items will be covered first. When presenting a case for PM to management, there is considerable temptation to include every piece of equipment, without fully appreciating the clerical, maintenance and supervisory work required to obtain good results. In the early stages, a program with a limited but well-defined scope can be managed much more efficiently than an ambitious plant-wide scheme. Besides, the results can be measured more accurately.

In every organization there are certain "key" facilities which have an immediate effect on production when not operating properly, as for example, the refrigeration unit in a dairy, or the ladle crane in a foundry. In such cases, available production and maintenance records should enable the excess costs arising from downtime on most key equipment to be measured, thus providing a definable goal for the program in terms of financial savings.

A proposal of this nature, which aims to save x dollars in y months on z machines is much more likely to win management support than a grandiose plan to reduce maintenance costs in a general way throughout the entire plant.

Furthermore, some equipment may have to undergo appreciable repair before being considered sound enough to operate reliably under scheduled preventive maintenance only. In such cases, the PM manager should insist that these costs are allocated to "special repairs" beforehand, and not allowed to handicap the PM program at the outset.

It is important to tell the production staff and other interested members of the organization precisely which equipment is covered by PM at any time, otherwise the program may be blamed for plant breakdowns outside its control. As confidence is gained, requests for increased PM coverage are likely to follow and discretion may have to be used to keep the program within practical limits.

Organize PM Team Carefully—Define Responsibilities

The supervisor or manager of the PM team should be a trained engineer with the additional attributes of an analytical mind and a liking for practical research. He should have no reservations about spending time at a desk working with drawings, cost records and other burdensome data, since many of the problems encountered will entail study, test work, analysis and report writing before arriving at the final solution. The ability to win cooperation from other departments (including the remainder of the maintenance division) and to inspire the entire PM group is another prime requirement.

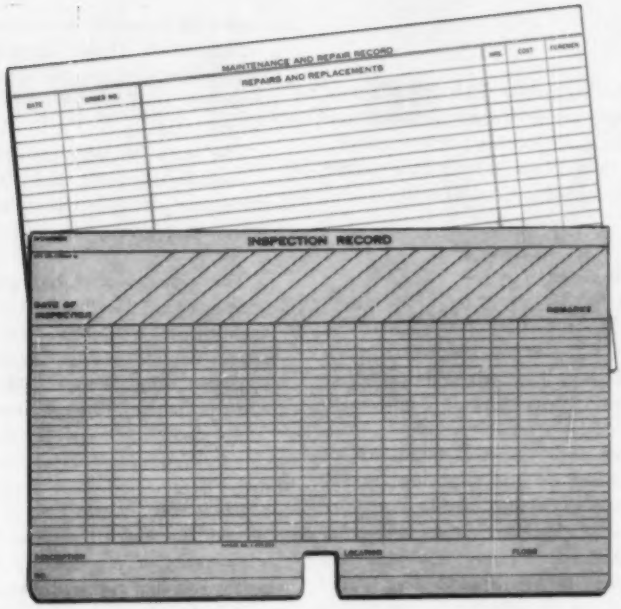
The PM supervisor must therefore be appointed with great care. If a member of the existing plant engineering department can meet the foregoing requirements, then promotion from within is generally a sound policy. If, however, no employee is really qualified for the job, a suitable man should be recruited from outside, instead of hoping that a dubious internal candidate will somehow make the grade.

When the group is large enough to justify an assistant to the PM manager, such a position affords an excellent opportunity for a junior engineer to gain solid experience in making tests, analyzing records, writing reports and helping to run a scheduled maintenance operation.

The clerical staff should preferably have had some experience in a maintenance department or an allied field, to insure that trade terminology is not a mystery. An aptitude for keeping records, some knowledge of scheduling, blueprint reading and office procedure is necessary; hence an ex-mechanic with no clerical experience whatever may prove an unfortunate choice, particularly in the early days of a new PM program.

The maintenance mechanics assigned to the PM group should also be chosen carefully. In each case, a good craftsman with the ability to reason clearly, write distinctly and who can be trusted to work on his own should be selected. There will be many occasions when inspection work has to be undertaken outside normal plant hours and this necessitates picking a conscientious team. Furthermore, no man should ever be assigned to the PM group because he has proved to be a problem to other maintenance supervisors.

Responsibilities should be clearly defined and all members of the group should be under the direct authority



Top illustration: Periodic check of repairs on a Maintenance and Repair Record will warn of future trouble. Bottom illustration: An Inspection Record form will provide you with a history of equipment inspections.

of the PM supervisor. During the formation of the group, this may require some firmness and tact on the part of the plant engineer and management, especially in those cases where seniority or long-established custom creates initial difficulties.

Nevertheless, it is most important that the PM group be given proper support and status from the beginning. Similarly, the group should be made responsible for its own records and given adequate office facilities in a suitable location. A few battered desks stuck in one corner of the maintenance department quickly impress everyone that PM is just that type of operation.

Whenever possible, the PM supervisor's office should be located close to the plant engineer's office, and in all cases his work should be classed as a major staff function, from the outset of the PM program.

Streamline Procedures—Establish Checkpoints

There is no universal PM clerical system and the best choice depends to a large extent on the individual needs and existing procedures found in each plant, since an unfamiliar system will create difficulties of acceptance and integration.

As to managing a PM program, it is essential to keep a close watch on the amount of clerical work involved, otherwise it may get out of hand and cause the savings margin to shrink. At the same time, a check must be kept on the information collected, to insure that it is sufficiently detailed, accurate and promptly used.

Filing

When only a limited PM program is adopted, the filing method provides a simple basis for the clerical and recording procedure. All pertinent data relating to each unit under PM is stored in an individual folder, and routine inspection and repair information is briefly noted on the respective machine history card or maintenance record sheet.

Preventive maintenance charges, inspection data, downtime and other relevant information are regularly posted from these files to a weekly PM sheet for review and action. However, this method is apt to prove cumbersome if the program grows appreciably.

Standard Forms

A popular PM procedure that is suitable for use in practically any size of organization is the use of standard forms which are available from most large business stationers. These forms are designed to accommodate information such as machine history data, maintenance records and costs, and by means of detachable copies, provide for scheduled inspection, repairs, stock withdrawals and labor control.

Unless skillfully designed, standard forms may involve an excessive degree of writing on the part of craftsmen and clerks, leading to wasted time and money, as well as the generation of still more pieces of paper. Consequently, the PM supervisor should constantly search for ways of reducing clerical work to a minimum by using whenever possible, the telephone, simple codes for observations and instructions, standardized schedules and procedures, and a self-posting record system based on pegged boards or other elementary principles. Much time can be saved by developing carefully prepared checklists for use by maintenance men in the field, and devising appropriate posting procedures for recording and administrative purposes.

Punched Cards

In some plants, most production, cost and maintenance data are accumulated on punched cards or tape. In such cases, if the information is sufficiently broken down, items of equipment in greatest need of PM programming can quickly be discovered by scanning the cards and selecting those machines registering more than one repair per week, say, or exceeding a certain sum in maintenance charges during any chosen period. Another suitable basis might be the individual downtime in terms of machine-hour rate, or the excess production cost arising from machine breakdown.

In addition to providing a basis for PM scheduling, when the stored information is sufficiently detailed, punched cards can also be used for preventive maintenance control and evaluation, since all labor and material costs pertaining to the PM program can be coded and fed back to the system. This enables accurate comparisons to be made between operations and units under PM and

those maintained by other means.

However, certain precautions must be observed when setting up PM on a punched-card basis. For instance, steps must be taken to retain the cards permanently, instead of discarding them at frequent periods. In addition, the data-processing unit should be checked to see if sufficient digits are available to store the detailed information required. If not, some form of coding will have to be devised.

Also, a good priority classification for PM work must be established by management in advance, otherwise it may be squeezed out of the data-processing system by other jobs and so jeopardize the whole preventive maintenance program. In one or two large organizations the maintenance divisions have their own machine-accounting centers, thus enabling the cost and progress of PM and other work to be summarized on the following day.

Statistical Sampling

In some plants where batteries of identical machines are in use, it has been found possible to reduce considerably the amount of PM clerical work by keeping accurate records on a few machines only, after these have been carefully selected on a statistical sampling basis. This procedure is facilitated by first putting every machine in good working order and insuring that all are used and operated to a reasonably equal degree.

Checkpoints

Reliable information is the basis of every PM program, hence the provision of clear, unambiguous checklists for use by inspectors and repairmen is essential. After the necessary work has been undertaken it should always be certified on the checklist by the man who undertook the task and all work on PM should be constantly spot-checked at random, by the PM supervisor or his deputy, who should indicate on the checklists the results of the inspections made.

Field checking has a double value, for it also enables the supervisor to hold discussions with his men and other plant personnel, thereby enabling him to keep abreast of changing events. Nor should it be forgotton that field checklists need periodic revision; otherwise they may become out of date.

In addition to inspecting work performed under PM standing orders, as itemized by the various checklists, it is important that jobs on PM work orders are also selected at random for thorough scrutiny, to insure that:

The Work Order contains no ambiguities and can be clearly interpreted by the tradesmen and clerical staff.

The work has been completed in a satisfactory manner by the tradesmen, in accordance with instructions given on the Work Order.

The clerical staff has correctly translated the Work Order into the appropriate material and labor charges, and has also posted the requisite information to the plant records in the proper manner.

The importance of establishing such checkpoints and using them constantly cannot be over-emphasized, for unless regular checking is undertaken by the PM supervisor, the entire program may gradually fail. It requires self-discipline on the part of any supervisor to carry out conscientiously a regular checking program and one way is to establish a rigid personal rule that, no matter what events may arise, time will be set aside each day to permit a minimum number of random inspections to be made.

Relating Preventive Maintenance to Production

In addition to watching closely the PM budget and cumulative costs, managing a PM program necessitates

(Continued on page 226)

PLANT NO. _____ MAINTENANCE COST SUMMARY SHEET PM AND GENERAL WORK FOR QUARTER ENDING _____ PREPARED BY _____

WEEK ENDING	COSTS					OTHER DATA				NOTES
	MAINTENANCE			PRODUCTION (DIR & IND)	TOTAL (MTCE & PROD)	DOWN TIME LOSS IN $	ALL MTCE ÷ TOTAL ($)	STD UNITS PRODUCED	$ ALL MTCE ÷ STD UNITS	
	PM	GENERAL	ALL							← REF. PERIOD
TOTAL										
AVERAGE										

COSTS INCLUDE MTLS, LABOR & OVERHEAD

A summary sheet similar to the one shown here will be beneficial in keeping track of all maintenance costs and at the same time will provide a good tool for showing the success of your preventive maintenance program.

Keep Tabs on YOUR SPRINKLER SYSTEM

This plant uses zones on each floor to quickly locate trouble

By **WALTER JACOBY**, Superintendent of Maintenance, Special Products Division
I-T-E Circuit Breaker Company, Philadelphia, Pa.

INDUSTRIAL sprinkler installations can cause extensive water damage if opened sprinkler heads cannot be pinpointed immediately. To begin with, instantaneous location of water flow is necessary to tell where a fire is located and a quick look around usually determines if the water flow must be maintained to extinguish or control the fire.

To be fully effective, a system for supervising water flow in sprinkler mains should be broken down into zones serving each area or floor in the system. This conclusion became obvious to us after a recent alarm. We ran to the top floor of an eight-story building, then searched each floor from the eighth to the first until the flow was located.

Each zone should also be equipped with its own shutoff valve and a drain valve to permit installing new sprinkler heads where needed. In our case, the entire building sprinkler service was shut down for draining.

This meant draining the complete system to replace one head when it opened on the first floor. Depending on the floor, flow location determined the number of floors to be drained. During these draining and filling operations, we were caught without sprinkler protection. In addition, our main flow gate was protected by flow switches wired to the American District Telegraph system which immediately notified the fire department. Arrival of city fire trucks was embarrassing when the alarm was caused by a defective sprinkler head.

To correct this situation, piping on each floor was divided into two zones per floor. Each zone covered an area 100 ft by 180 ft and was served from a main riser. A gate valve served each zone from the main riser.

Downstream of each zone gate valve, a drain valve was connected so that each zone could be shut off and drained without affecting the remainder of the system. This solved the problem of system drainage and left only one zone without sprinkler protection when draining to replace a sprinkler head.

Flow and gate valve switches had to be installed to eliminate the search necessary to locate the flow area. An approved flow switch was installed downstream of each zone gate valve. These switches were installed in the existing piping by cutting a hole in the pipe. The switch is actuated by a thin paddle which is deflected when a flow occurs. An approved gate valve switch was also installed on each zone gate valve. These switches were readily mounted on the valve stem assemblies.

Both gate and flow switches are designed to be tamperproof. The switches have a normally open, held-closed tamper switch which operates whenever the cover of the switch is removed. Operating a drain valve alone will actuate the flow switch due to its location, thus supervising flow through both zone main and zone drain piping.

Electrical control circuits employed in this system use a closed loop to instantly detect an open wire or component failure. Many approved alarm circuits consist of open circuit wiring and develop faults that are not noticed until a fire occurs with no alarm indication.

Our first step was to supervise operation of the fire pump. This was accomplished by connecting a 480 to

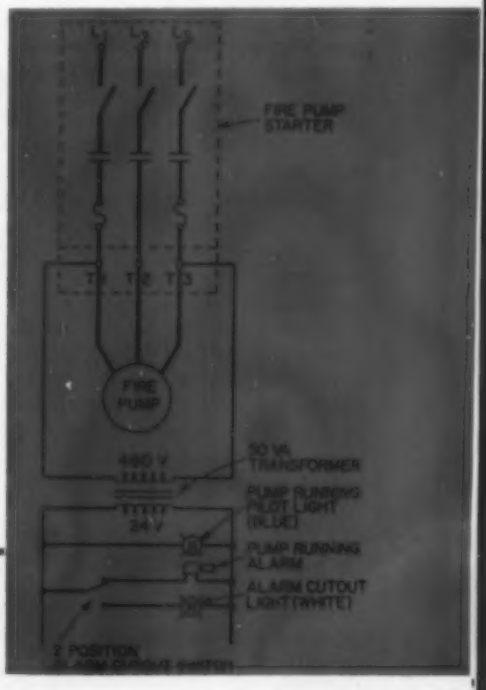
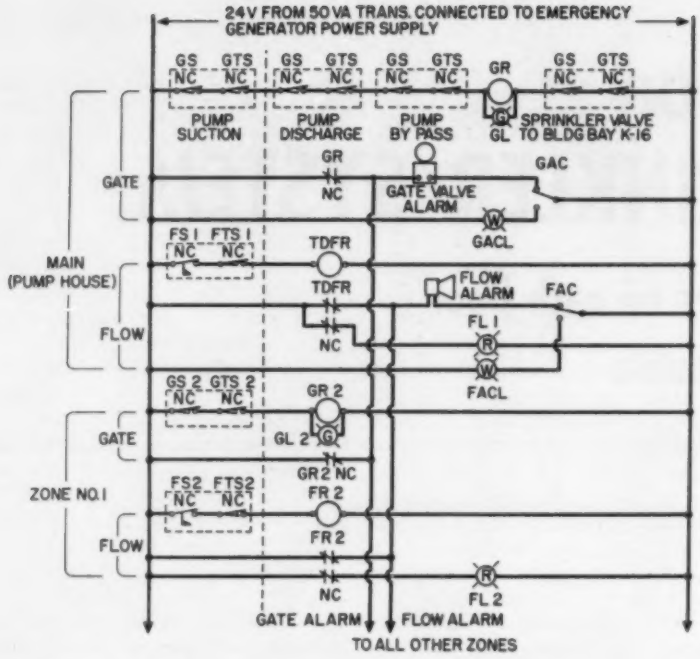


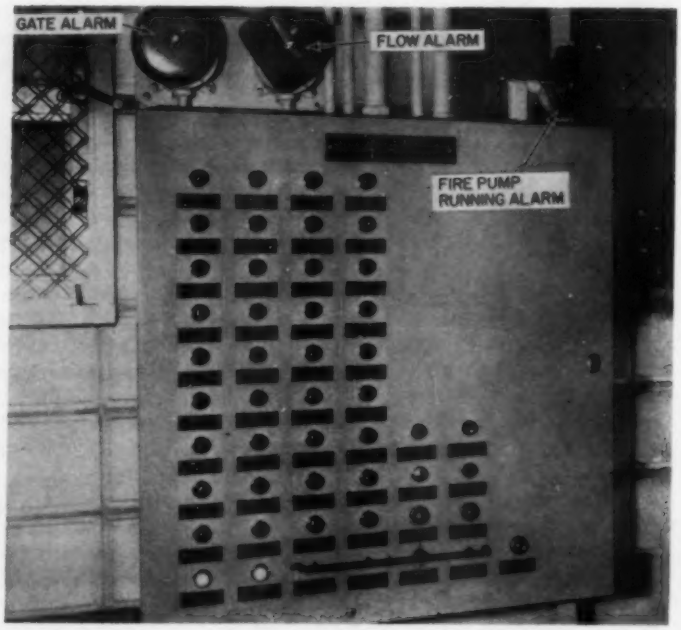
Fig. 1. Transformer connected to load side of fire pump starter furnishes power to supervise operation.



GS GATE VALVE SWITCH
GTS GATE VALVE TAMPER SWITCH
GR GATE VALVE RELAY
GL GATE VALVE PILOT LIGHT (GREEN)
GAC GATE ALARM CUTOUT SWITCH
GACL GATE ALARM CUTOUT PILOT (WHITE)
FS FLOW SWITCH
FTS FLOW TAMPER SWITCH
TDFR TIME DELAY FLOW RELAY
FAC FLOW ALARM CUTOUT SWITCH
FACL FLOW ALARM CUTOUT SWITCH (WHITE)

Fig. 2. Schematic drawing of alarm circuit. All zones in building are wired uniformly as shown for zone 1.

Fig. 3. Supervisory alarm panel installed in main guard house. Three alarms are shown at top of panel.



KEEP TABS ON SPRINKLER SYSTEM

24 v, 50 va transformer across the load side of the fire pump motor starter, Fig. 1. Whenever the pump runs, this transformer becomes energized and the pump running pilot light (blue) lights up. At the same time, the pump running alarm is energized, calling attention to the fact that the fire pump is running. This alarm can be silenced by operating the two-position switch connected to the alarm. When this is done, a white pilot light is illuminated to show the alarm switch is in the cutout position.

To insure proper operation of the fire pump when needed, an additional circuit, Fig. 2, supervises the position of the suction, discharge and bypass gate valves in the main pump house. When these are in their normal position, the gate switches are held closed. Each gate switch is further protected by a tamper switch which is wired in series with the gate switches. When alll these switches are held closed, a circuit is completed to the gate relay, GR-1, which becomes energized and opens the normally closed contact, GR-1, in the gate valve alarm circuit. A green pilot light, GL-1, lights up to indicate all valves are in their normal positions. Moving any valve from its normal position will open the circuit to gate relay 1, which will drop out, closing the normally closed contact GR-1 and sounding the alarm. An alarm cutout switch is provided to silence the alarm and illu-

minate a white pilot light to indicate the alarm is cut out.

A flow switch, FS-1, is also located in the pump house to detect water flow. When this switch is operated by water flow, the time delay flow relay, TDFR, drops out. After about 11 seconds, the TDFR contacts close, sounding the flow alarm. This time delay insures a positive flow of water through the mains before energizing the flow alarm. There are no retard switches in this system. When all air is removed, floating of water is eliminated and only actual flow is indicated.

All zones in the building are wired uniformly as shown for zone 1 in Fig. 2. Gate switches keep gate relays energized and hold open the normally closed gate relay contacts to the gate alarm. Green pilot lights indicate proper operation of gate valve circuits. Similarly, flow switches keep flow relays energized and hold open the normally closed contacts of the flow relays. Any interruption to this circuit by tampering with the switch or a flow in the zone will break the circuit to the flow relay. The normally closed flow relay contacts will then close, sounding the flow alarm. Immediate location of the zone is indicated by noting which red flow pilot light has gone out.

The main supervisory alarm panel, installed in the main guard house, is shown in Fig. 3. Each floor is divided into two zones and the pilot lights indicate gate valve position or flow in either zone for each floor. As an example, the top row of pilot lights indicates, from left to right, gate and flow in the west end of the building and gate and flow in the east end of the building. Nine rows of pilot lights supervise all floors in the building.

Alarms Installed in System

At the bottom left of the panel, the two white alarm cutout pilot lights are shown. Under the protective bar across the bottom, are located the alarm cutout switches and the emergency start button for the fire pump. Other pilot lights at the right indicate availability of fire pump power, fire pump running pilot light and fire pump alarm cutout pilot.

At the top of the panel, three alarms with distinctly separate sounds indicate gate valve operation, flow or fire pump operation. When any of these alarms operate, a quick visual check of the pilot lights pinpoints the cause.

Zone flow and gate valve switches are mounted as shown in Fig. 4. This is a uniform method that was used on each floor. A permanently mounted ladder is located at zone gate valve position for testing and draining the system.

A smaller improved supervisory panel is shown in Fig. 5. This panel employs sealed, plug-in relays in place of open relays used in the main panel. A spare relay is kept on hand and can be readily inserted into any circuit in the system suspected of relay trouble.

Spare space provided will not only allow expansion of the sprinkler supervisory system but will also allow supervision of generator voltage, steam pressure, water pressure, power voltage and power and light ground detectors. These items, all supervised from the main guard house, provide a guard with necessary information to spot trouble. In many cases they can avoid costly shutdowns resulting from confusion and delay of normal breakdown reporting procedures. **End**

Fig. 4. Zone flow switches and gate valve switches are arranged on each floor in this standard arrangement.

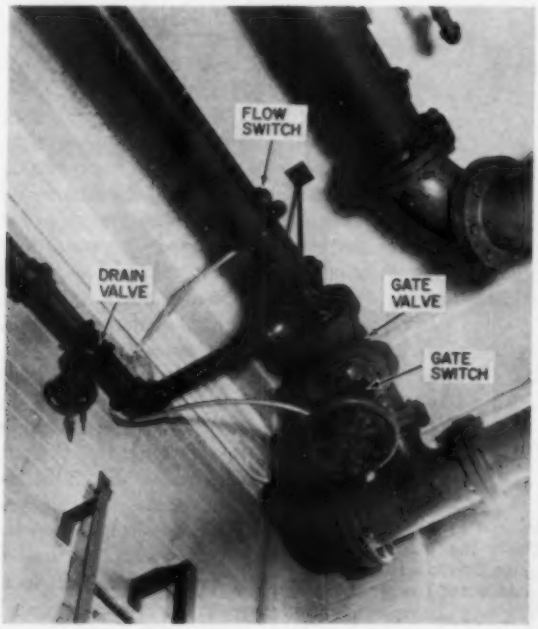
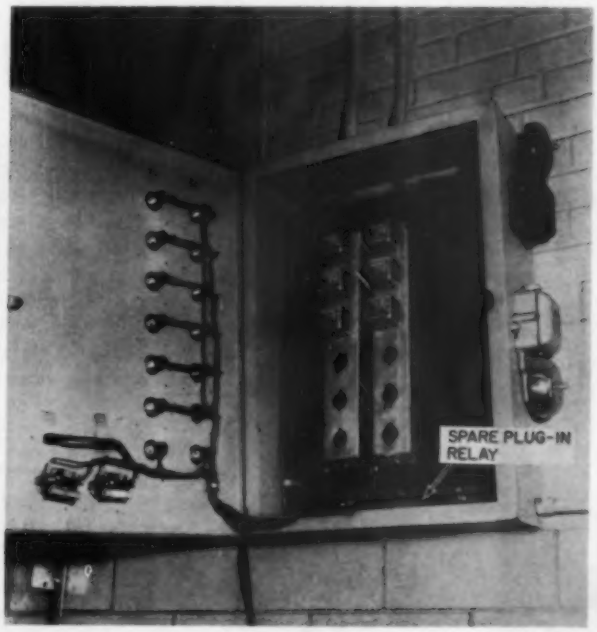


Fig. 5. Improved supervisory control panel employs sealed, plug-in relays in place of open relays used in the main panel.



TV CAMERA HELPS GUARD REMOTE GATE

Camera is mounted inside a weather-proof housing 18 ft above the truck gate area. Camera's focus, brightness and iris opening can be adjusted from control unit in main guard house.

GROWING PAINS priced at $15,000 a year were eliminated by a remote control gate installation at the main plant of Kordite Corporation, plastics manufacturing firm in Macedon, New York.

A remotely-controlled mechanical device opens and closes the gate, speaker-microphone units provide voice communications and a Motorola closed-circuit television system keeps an electronic eye on the operation. Control point is the central guard office at the main gate, 1000 feet away. There, one man controls and guards both entrances.

Kordite's growing pains came with the opening of a new warehouse on December 1, 1960. The shipping dock was extended across a plant road to join the warehouse. Vehicles going to and from the receiving department at a back corner of the company's property could no longer use the front gate or the plant road.

A 12-ft-wide gate was installed

Far left: Guard in main guard office can watch truck at remote gate via closed-circuit television system.

Left: Truck drivers can remain in their cabs while talking to guard through speaker-microphone units mounted on each side of 12-ft gate.

near the six-truck receiving dock. Trucks enter the plant at the remotely-controlled gate instead of using the company's front gate. This avoids driving through company property. Congestion at the front gate has been relieved and a better traffic situation exists within the plant property.

To man the new gate, however, the company was faced with adding three men to its guard force. Instead, television and automatic control combined to do the job—hence, the $15,000 annual saving. The cost of system was less than half this amount; consequently, six months' operation paid for the equipment.

A Motorola television camera is in a weatherproof housing mounted atop an 18-ft pole, overlooking the gate and its approaches. Automatic focus, brightness adjustment and iris opening is applied to the industrial TV camera from a control unit in the main guard office.

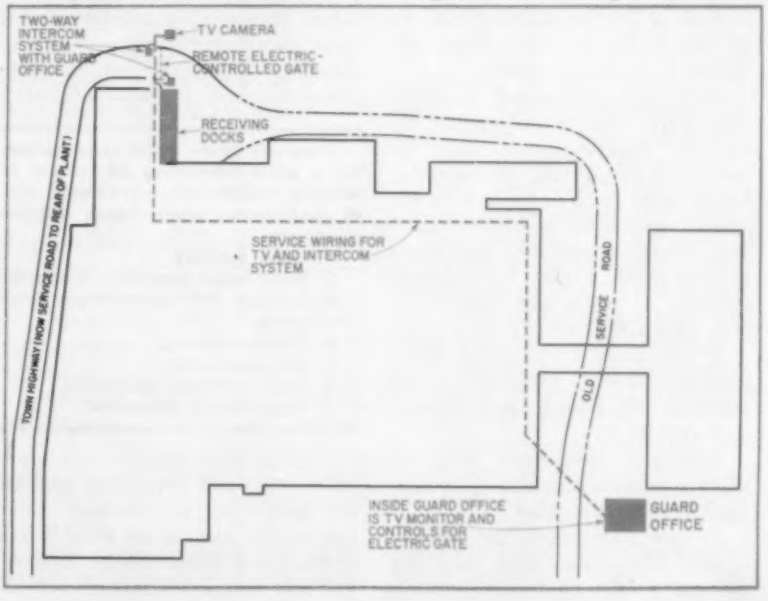
Cable connects the camera to a 14-in. monitor mounted in the guard office. Normal home-style picture controls are available at the monitor.

Originally, the company expected that it would be necessary to handle identification at the gate through the intercom system. However, they found that the quality of the television picture enabled the guard to make visual identifications. To further improve the image, two groups of neon lights were mounted above the gate area. The round-the-clock illumination increases the light at the scene by 15 fc.

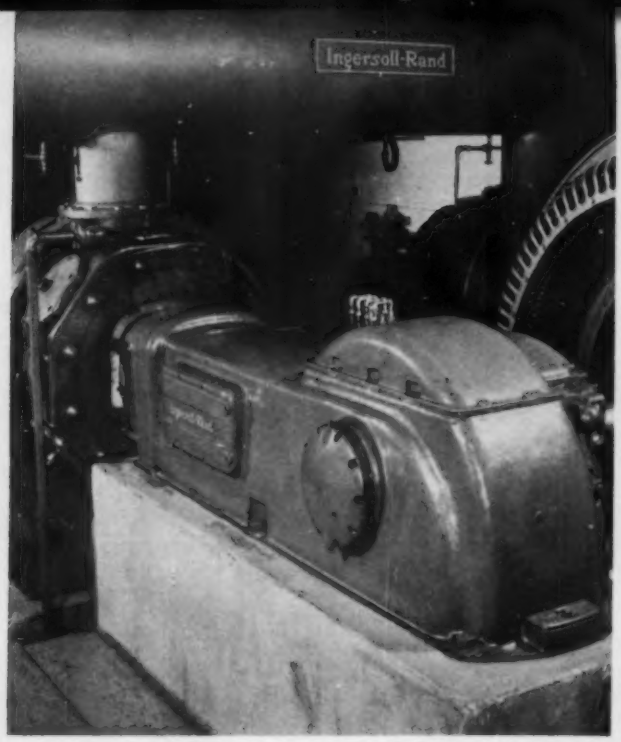
The gate-operating mechanism is an electrical device which opens, closes or stops the motion of the sliding gate by the touch of a button in the security office. Voice communications work through speaker-microphone units mounted on each side of the gate at truck cab height and an office intercom unit. Drivers using the gate remain behind the wheel while giving company name and exchanging other information with the controlling guard at the front gate.

The observation and control system is at work 24 hours a day, seven days a week. **End**

Sketch shows the relationship of the remote control gate entrance to the main guard office. Distance from remote gate to the main gate is 1000 ft.


TWO-WAY INTERCOM SYSTEM WITH GUARD OFFICE
TV CAMERA
REMOTE ELECTRIC-CONTROLLED GATE
RECEIVING DOCKS
SERVICE WIRING FOR TV AND INTERCOM SYSTEM
TOWN HIGHWAY (NOW SERVICE ROAD TO REAR OF PLANT)
OLD SERVICE ROAD
INSIDE GUARD OFFICE IS TV MONITOR AND CONTROLS FOR ELECTRIC GATE
GUARD OFFICE

LUBRICATION NEEDS OF COMPRESSORS



By B. M. DUNHAM, Technical Consultant, Sun Oil Company

PROPER LUBRICATION of air compressors pays off in lower lubrication costs, lower maintenance costs, more reliable compressor operation, lower power consumption, and safer operation.

Only the bearings of rotor-type centrifugal compressors require lubrication since there are no cylinders to lubricate as in a reciprocating engine. The bearings may be the grease-lubricated antifriction type, or oil-lubricated plain bearings, where oil is carried in a reservoir in base of bearing housing with an oil ring to dip into the oil and distribute it around the bearing.

Multistage centrifugal compressors may, when pressures are increased, require special shaft oil seals and circulating oil systems. Large types, such as those used for critical applications in blast furnaces and Bessemer converter operations in steel mills, usually have a combination of main and Kingsbury-type thrust bearings. They are usually lubricated by a pressure-circulation system utilizing an oil reservoir, oil pumps, and oil-pressure regulators.

Axial-flow compressors may be plain or antifriction and may be ring-oiled or circulation-oiled.

At very high speeds, the problem of fluid friction may arise, requiring the use of the lightest-bodied oils that will form adequate lubricating films. However, the lubrication problem is concerned only with the bearings; the blades require no lubrication.

Rotary compressors include the Roots, rotary-liquid-piston, and sliding-vane types. Lubrication is confined to the bearing except for the sliding-vane type. This type requires forced-feed lines to deliver lube oil into the vane slots and along the vane edges that come in contact with the inner wall of the cylindrical housing. Some air entrainment of oil particles may be encountered when the air is compressed between the vanes.

There are seven major requirements for a good lubricating oil for use in rotating compressors—centrifugal axial, and rotary types. These requirements are:

1. **Good stability**
2. **Good water separation properties**
3. **Antirust and anticorrosion properties**
4. **Proper viscosity**
5. **Low pour point**
6. **Good antiwear properties**
7. **Nonfoaming properties**

High-quality stabilized oils used in bearings and circulating systems of rotor-type compressors offer longer life and more trouble-free service than lower-quality uninhibited oils. Rust- and oxidation-inhibited oils resist oxidation deterioration such as sludge formation, acidity and excessive oil thickening. They are, therefore, recommended for these applications.

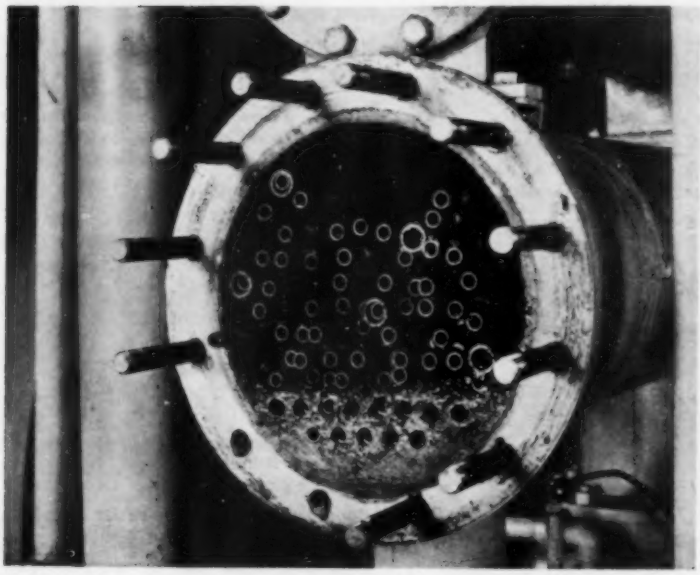
Good water-separation or "demulsibility" properties of a compressor oil apply mainly to lubrication by the circulation-system method. It assures rapid separation of the oil from any water that may be present and therefore protects against the formation of persistent and harmful emulsions and sludges which may interfere with oil distribution. However, as will be pointed out later, an emulsion of the right kind may be desirable for multistage reciprocating compressors.

Compressors may operate under severe conditions of moisture, dust, sand, grit and other contaminants encountered in construction, steel-mill operations, etc. Moisture from the air may combine chemically with ferrous metals to form rust or corrosion. So it is important that oil used in compressors have normal rust- and corrosion-inhibiting properties which have been fortified by the careful blending of the right additives.

Viscosity is the resistance of an oil or fluid to flow; thus it is fluidity. Light oils flow readily, while the heavier more viscous oils flow less readily. The proper viscosity

Left: Proper lubrication of air compressors will result in lower lubrication, maintenance costs and also insure a more reliable compressor operation.

Below: Gummy carbon deposit in aftercooler was probably caused by a high carbon-content lubricant.



for rotor-type compressor bearings is generally based upon speed of shaft. If the oil is too light, it may not carry the load and, if too heavy, causes overheating due to fluid friction.

Viscosity index, a measure of change in viscosity with change in temperature, may also be important if the units are located in a cold atmosphere. High-viscosity-index oils should be used if there is a wide ambient temperature range of application. This is especially important for portable rotary units employed in outside work.

Low pour point refers to the ability of the oil to flow readily at low temperatures. A compressor oil must flow at the lowest atmospheric temperature at which it is expected to operate. A portable compressor used outdoors in cold weather would need oil with a low pour point. For a stationary compressor operating in a heated enclosure or building, the pour point can be relatively high, and pour point could be sacrificed in order to gain other advantages, if necessary.

Good wear-resistance can be affected by changing the viscosity, film strength, load or pressure-bearing characteristics, or by the rust- or corrosion-inhibiting characteristics of the oil. The anti-wear properties of the oil can be greatly improved by the use of suitable additives. Actual operating conditions, service loads, and compressor types should all be considered, and it is best to consult a qualified lubrication specialist for recommendations in specific cases.

Foaming is caused by air being churned into and retained by the oil. In ring-oiled plain bearings, for example, the oil is exposed to oxidation influences through the churning and splashing of oil in contact with warm or hot air in the bearing housing. If the oil foams readily under these conditions, it may overflow the reservoir. Circulating systems, particularly on portable rotary compressors, are the most critical and if foaming does occur, anti-foam additives may be used to treat the oil.

The lubricating requirements of reciprocating compressors differ considerably from those of the rotor-type. In addition to bearings of all types, reciprocating compressors have pistons, cylinders, piston rings, valves, and crankcases, all of which require lubrication.

Lubrication of the cylinder walls is the most important consideration in lubrication of reciprocating compressors. The related problems previously covered—operating temperature, stability or oxidation, con-

tamination, and moisture or water are complicated by the fact that, because of the piston movement, only thin films of oil can be permitted on the cylinder walls. Use of intercoolers to cool air between stages further complicates the situation by introducing entrained water and oil to the suction air in the higher-pressure stages.

The five major requirements of a good lubricating oil for use in piston-type compressors are:

1. **Explosion prevention**
2. **Valve cleanliness**
3. **Rust prevention**
4. **Preferential wetting**
5. **Wear resistance**

Fires and explosions in air-compressor discharge systems can and do happen. Although the cause may not always be definitely determined, it is highly probable that excessive deposits and high discharge temperatures are necessary conditions. It used to be a theory that a high-flash-point oil would eliminate the cause of fires and explosions, but tests have shown that temperatures much higher than the highest flash point of any lubricating oil are necessary for true auto-ignition.

Most air compressor explosions seem to have been caused by the accumulation of oxidation deposits combined with combustible contaminants such as ordinary dust, coal, flour, paper dust, etc. The generation of heat from these layers or deposits may so weaken the walls of a discharge pipe or other part of the discharge system as to cause an explosive rupture. Or a fragment of a glowing deposit can be carried by the air stream to a point where a combustible mixture exists.

Clogged discharge valves may also allow feedback of heated air from a higher to a lower stage, causing a cumulative buildup of temperature to or above the spontaneous ignition temperature of the oil.

The best assurance against this potential hazard is to use a compressor cylinder oil that forms least carbon deposits and to inspect valves frequently. A naphthenic base oil properly inhibited to reduce carbon-forming tendencies has been proven to be the best type oil to use.

Valve cleanliness is a function of oil stability and carbon-forming tendency since the heavier the deposits caused by oil deterioration, the "dirtier" will be the valves. The

SELECTING THE PROPER TYPES OF COMPRESSOR OILS
(Based Upon Specific Operating Conditions)

Type of Compressor and Operating Conditions	Recommended Type of Oil To Minimize Operating Difficulties
RECIPROCATING-TYPE	
Excessive carbon buildup on discharge valves, lines, coolers	**Naphthenic oil**
Rust protection required	**Rust-inhibited oil**
Condensation occurring on cylinder walls resulting in wear	**Compounded or detergent oil**
Scuffing occurring attributable to inadequate film strength of oil	**Oil with antiwear additive**
Abnormally low temperature operation	**Low pour test type oil**
Abnormally high temperature operation	**Oxidation-inhibited oil of adequate viscosity**
High-pressure, multistage systems	**Naphthenic oil**
Crankcase lubrication separate from cylinder lubrication:	
Cylinders	**Dependent upon operating conditions above. For normal conditions, naphthenic oil is preferable**
Crankcase	**Rust and oxidation-inhibited oil**
Fires or explosions occurring in system	**Naphthenic oil**
Air compressors used in connection with diesel engines	
For starting air compressor	**Above recommendations apply. If outside unit, generally same oil is used as for diesel crankcase**
Injection air compressor	**Compounded oil**
Superchargers or scavenger blowers supplying air directly to engine	**SAE-10 or 10W oil or same as used in diesel crankcase if not too heavy**
Gases other than air:	
Such as carbon dioxide, hydrogen, ammonia, nitrous oxide, hydrogen sulfide, sulfur dioxide	**Straight mineral oils**
Petroleum gases—(H_2, CH_4, C_2H_2, C_2H_4, C_3H_8, C_3H_6, C_4H_8, C_4H_{10}) —Dry	**Straight mineral oils—one grade heavier than for same type compressor processing air**
Wet entrained gases	**Compounded oil to resist washing effect**
Unstable gases	**Detergent-type oils to prevent gum deposits**
ROTARY POSITIVE DISPLACEMENT COMPRESSORS	
Any	**SAE-40 rust- and oxidation-inhibited oil with high film strength or detergent oil**
CENTRIFUGAL BLOWERS	
Bearing lubrication only	**Usually grease lubricated**
VACUUM PUMPS	**High viscosity index oils having low vapor pressure characteristics**

NOTE: Proper viscosity of lubricating oil is dependent upon the design of the individual compressor and the conditions under which it operates. Refer to manufacturer's recommendations.

serious trouble caused by formation or deposits on valves causing "wire-drawing" or recompression of air has been discussed above.

Viscosity also enters the picture, since a heavy oil will—other things being equal—lead to heavier deposits. Therefore, the lightest oil with the best film strength that adequately lubricates is the best to apply. Foreign particles or other external contaminants, however, can become a problem here if suitable air filters are not employed.

The discharge valves are, of course, at the final temperature of the compressed air, which may be very high. Thus at the discharge valve there is a strong likelihood that deposits will form because there is a thin film of oil constantly on a hot surface.

Moisture may be a problem in reciprocating air compressors, especially in multistage machines having intercoolers in which entrained or condensed moisture is carried into the higher-pressure stages. The water thus formed tends to displace the thin films of oil from the cylinder-wall surfaces, exposing them to rusting. But this continual removal of rust exposes new surfaces to additional rusting and to abrasion from entrained rust particles.

The rust buildup, which is cumulative, also tends to promote oxidation by catalytic action. The rust is eventually carried to the discharge valves and contributes to the formation of deposits there. It is obvious that rust-inhibiting properties of a compressor oil are of considerable importance in cylinder-wall lubrication.

To combat the "water washing" of the cylinder walls and the consequent formation of rust, a good compressor oil, in addition to its rust-inhibiting properties, should also be able to wet metal surfaces in preference to water. It should distribute readily in the presence of moisture to form and maintain strong oil films on cylinder surfaces to guarantee proper lubrication. Sometimes a small percentage of a wetting agent is added to a mineral-oil base to allow preferential oil wetting.

Lubricating oil in a reciprocating compressor system must not only reduce friction and wear between rubbing surfaces (piston rings and cylinder wall), but also provide an adequate piston ring seal against the escape of air.

When the operating temperature in the cylinders rises, the viscosity of the oil will decrease, thus increasing the distribution of oil over the cylinder walls; but if the increase is too great, the film strength of the oil will suffer, thus causing wear in the cylinder walls. An oil of higher viscosity will tend to distribute poorly, requiring excessive feeds.

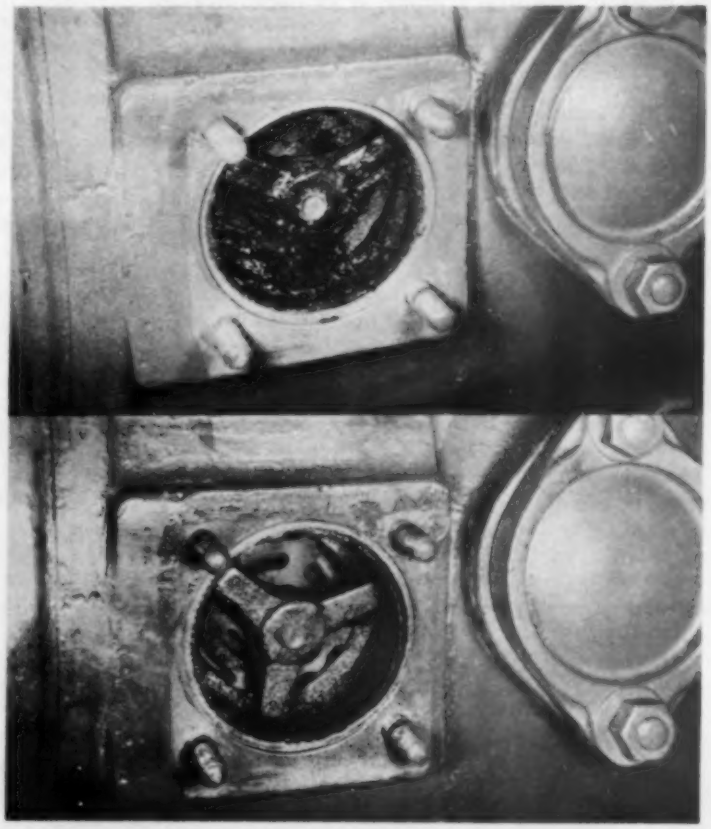
Heavy oils also tend to hold solid contaminants such as dust, soot, sand, etc., more readily than lighter bodied oils, thus contributing to the buildup of deposits in piston ring grooves, valves and discharge passages.

As the operating temperature in the cylinder wall increases, the thin films on the cylinder wall are continually swept away by the hot air under pressure, causing the oil to oxidize and form insoluble deposits which, combined with contaminants, act as abrasives.

In a correctly-designed compressor oil for high-temperature service, such deposits can be kept soft and fluffy by proper selection of the base oil with a minimum tendency to abrade or cling to metal surfaces. Anti-wear additives aid substantially in reducing cylinder and ring wear.

Choosing the right lubricant means that it can be reused over longer periods of time and only minimum quantities will be consumed. This means lower costs for the lubricant itself, and also leads to lower maintenance costs by prolonging the life of lubricated parts and reducing downtime and replacement part costs. Greater reliability is also likely, provided there is regular maintenance and inspection of the compressor as a whole and especially of the aftercooler, discharge lines, oil separator, and drains.

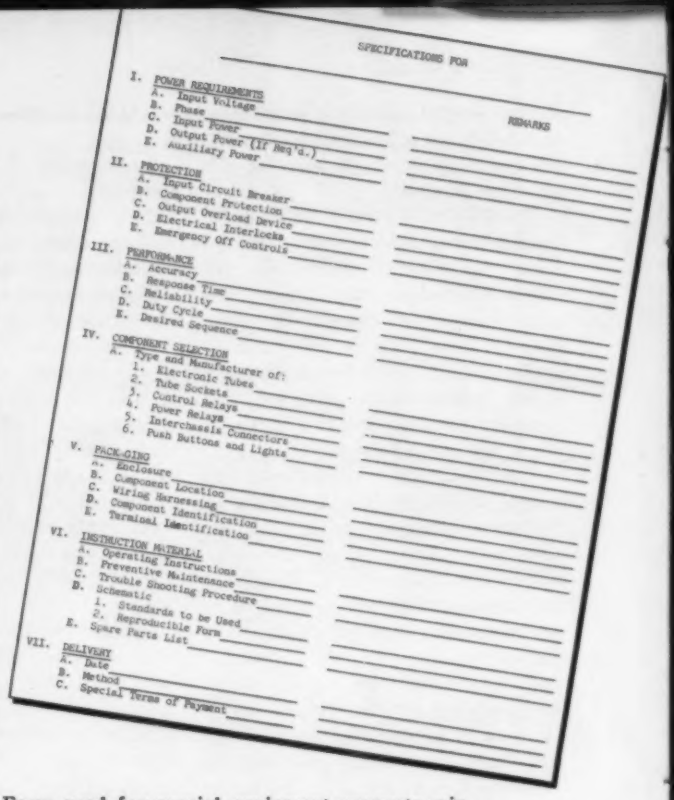
When the right compressor lubricant is used and there is a regular inspection and checkup program, the possibility of fire or explosion is extremely unlikely. **End**



Top illustration: Wrong oil clogs exhaust valves. Bottom illustration: Switch to better oil resulted in a noticeable difference in valve deposits.

SPECIFYING SPECIAL* ELECTRICAL EQUIPMENT

By **J. O. SEYMOUR, JR.** and **G. S. PAIL**
Equipment Development Engineers
Westinghouse Electric Corp., Sharon, Pa.


SPECIFICATIONS FOR

REMARKS

I. POWER REQUIREMENTS
A. Input Voltage
B. Phase
C. Input Power
D. Output Power (If Req'd.)
E. Auxiliary Power

II. PROTECTION
A. Input Circuit Breaker
B. Component Protection
C. Output Overload Device
D. Electrical Interlocks
E. Emergency Off Controls

III. PERFORMANCE
A. Accuracy
B. Response Time
C. Reliability
D. Duty Cycle
E. Desired Sequence

IV. COMPONENT SELECTION
A. Type and Manufacturer of:
1. Electronic Tubes
2. Tube Sockets
3. Control Relays
4. Power Relays
5. Interchassis Connectors
6. Push Buttons and Lights

V. PACKAGING
A. Enclosure
B. Component Location
C. Wiring Harnessing
D. Component Identification
E. Terminal Identification

VI. INSTRUCTION MATERIAL
A. Operating Instructions
B. Preventive Maintenance
C. Trouble Shooting Procedure
D. Schematic
1. Standards to be Used
2. Reproducible Form
E. Spare Parts List

VII. DELIVERY
A. Date
B. Method
C. Special Terms of Payment

Form used for special equipment prevents misunderstandings about the required specifications.

Such equipment is not usually available as a standard product and, if the equipment cannot be built in the user's plant, it is necessary to purchase the equipment from another source.

EVERY industrial plant, large or small, has an engineer or group of engineers with the almost endless task of specifying and procuring special manufacturing, processing, and testing equipment.

Probably the most important point to make in any specification is the use to which a special piece of equipment will be applied. The supplier can sometimes be very helpful if he has a good understanding of the requirements. If the equipment to be purchased is part of an over-all system, the supplier should be aware of the part his equipment will play in the system.

This will generally require a complete exchange of information by purchaser and supplier to assure compatibility when the equipment is integrated into the system. The supplier should also be aware of the product to be tested or processed with his equipment, with respect to range of sizes of units to be tested or processed. Quite often a piece of equipment will be delivered to the purchaser who subsequently finds he did not specify enough capacity to fulfill his needs.

It is important to specify whether the equipment will be used in a production line or in a laboratory facility. Equipment which can be used on a production line is quite often not suitable for laboratory, testing or processing. Precision equipment for use in a laboratory generally requires more downtime for maintenance than a production schedule will allow. Personnel in these two areas differ greatly in many plants as laboratory personnel can calibrate the equipment and usually understand it better than production people.

A general rule to follow is simplicity for production equipment and precision for laboratory equipment. For the sake of simplicity in production equipment, accuracy may sometimes be lower than ideal, but a reliable piece of equipment in the production line will usually more than compensate for the loss in accuracy.

The engineer should consider the environment in which the equipment will be used. He may find it necessary to specify the use of air filters in dusty areas. A piece of portable equipment should be built sturdier than a piece of stationary equipment, and if the equipment is subject to bumping by fork trucks and skids, it should be designed to withstand this abuse. General shop environment is not too severe on equipment but in chemical vapor atmospheres additional protection will have to be given the equipment. It may even be necessary to specify static or sealed control components in an explosive atmosphere where any arcing of contacts would be a hazard.

Test Insulation of Equipment

All pieces of equipment should have the wiring and control components tested for insulation strength to ground. This is a safeguard in case overvoltage is applied by mistake. Voltage surges in the power line often cause trouble in poorly insulated circuits. However, a properly selected low voltage surge arrester tends to minimize this problem.

Method of protecting electrical parts of the circuit should be specified. A disconnect switch in combination with fuses or circuit breakers is suitable and both are available to cover a wide power range.

Economics and ease of replacement should be considered here before choosing breakers or fuses. If fuses are used, it is usually worthwhile to specify an indicating type fuse. This is especially helpful in a large system so the circuit location of a blown fuse can be readily identified.

A description of the preventive maintenance which the equipment can be expected to receive when in use should be furnished to the supplier. If a complete preventive maintenance schedule is not possible, the supplier should use components which do not require constant lubrication, or cleaning. Electrical parts can be slightly de-rated to assure a longer life before replacement.

It is sometimes difficult to shut down a production line to check electronic tubes or to lubricate and clean air valves; however, if these conditions are anticipated, the designer can take them into account. The engineer should also require a detailed preventive maintenance schedule from the supplier to assure adequate protection of all components.

In general, voltage and current needed to operate equipment will be available throughout the plant. However, when special auxiliary power sources such as air lines are needed, they are not always available. It is good policy to tell the supplier exactly what you have in the area to power the equipment. He should design to these limitations and eliminate the necessity of special power lines for the equipment.

If direct current power is required for part of the equipment, it may be more economical to have the supplier incorporate a rectifier circuit in his design and eliminate the need for d-c power lines for the equipment. Many items of equipment have been purchased for use in areas where available power was found to be inadequate. If special power lines are required, provision should be made to have such service available well ahead of receipt of the equipment.

In general, acceptable power and control circuit specifications can be made with an industrial code as a guide. One of these codes is the J.I.C. Electrical Standards (Joint Industry Conference). A.S.A. standards are also a good guide to specifying circuitry requirements. Some large companies have their own standards in a form which can be sent to prospective suppliers.

Engineers who specify equipment to be purchased from an outside supplier should have a listing of preferred components from which they can specify the exact type and manufacture of each component to be used. A listing of this type is not easily assembled but if time and effort is spent to gather it and keep it up-to-date, everyone concerned with the equipment will benefit.

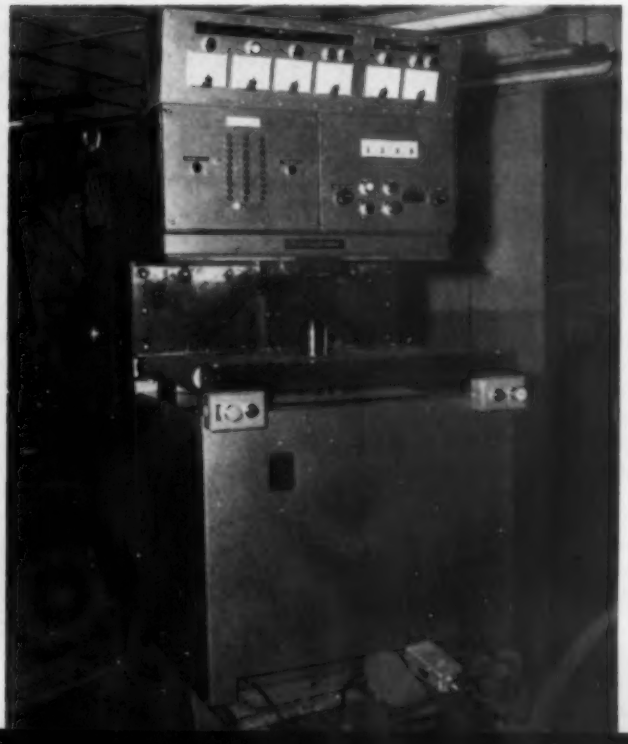
Design draftsmen in the section specifying the equipment will have the list to refer to when laying out control panels for equipment. Maintenance personnel will have a simpler job of keeping replacement parts on hand if all the equipment they are responsible for does not require different relays, pilot lamps, terminal blocks, etc.

A component listing can be small or very large depending on the degree of standardization which the specifying group desires. The scope of the equipment specified will determine to a large extent the inclusiveness of the listing.

Many companies, who specify outside purchase of equipment, manufacture many of the components used in general control circuitry. This is true of larger companies. The standard component listing will of course include products available from other divisions or plants of the specifying company.

A representative listing of components for general con-

Special equipment for making digital measurements of voltage, current and power.



Test fixture for making preliminary excitation loss studies on transformer cores.

trol circuitry on test sets, machine controls, and conveyor controls will probably include the following items:

- Control transformers
- Control type relays
- Telephone type relays
- Industrial electronic tubes
- Limit switches
- Cabinet door interlocks
- Air solenoids, filters
- Static control components
  - Magnetic amplifiers
  - Logic elements
  - Proximity switches
- Cabinets and consoles
- Indicating lamps
- Pushbuttons and contact blocks
- Wiring duct or trough
- Terminal blocks and marking
- Control wiring (color code)
- Binding posts
- Circuit breakers, enclosures
- Fuse types

Each item on the listing should have a preferred manufacturer and type number or style number. These items should be referred to when preparing the equipment specifications and if reliability and standardization are to be inherent in the equipment, the exact items should be given in the specifications if they are known.

If the items are not known at the time of specifications, the supplier should be given a list to refer to when designing the equipment. This is particularly true when specifications are made for a new or undeveloped piece of equipment. The success of equipment in the production line often hinges on how well the components were specified by the engineer.

In general, packaging of the equipment components will be dictated by the components themselves. However, in some cases a definite space allowance has been made for a piece of equipment. This should be stated in the specifications as a guide for the supplier. It is very costly and time-consuming to have to rearrange the area when the supplied equipment will not fit the allotted area.

In equipment consoles and cabinets, easy accessibility to the components is essential. The number and location of doors and removable panels should be specified when necessary. The ease with which repairs and maintenance can be made should be a primary consideration for production equipment and the specifications for any equipment should stress this point.

Standardize on Consoles and Cabinets

Some degree of console and control cabinet standardization should be made if possible. The availability of spare panels, doors, locks, etc., is greatly increased if other cabinets of the same type are used in the plant. The appearance of areas of the plant are enhanced when consoles and cabinets of the same type are used.

One phase of specifying equipment often overlooked by inexperienced personnel is the necessity of complete instruction and maintenance manuals. The content of instruction manuals and the detail with which the equipment is explained depends primarily upon the complexity of the equipment; for this reason it is difficult to set up definite requirements for the context of instruction manuals. However, certain basic items should be contained in any instruction manual if it is to fully describe the equipment.

Purpose of the equipment should be included to explain and to prevent misuse of the equipment. All limitations and expectations regarding accuracy, response time, general application and general operating characteristics should be outlined in this section. Detailed calibration procedure, if required, should be included. Power requirements should also be included in this part of the manual if the equipment is of a portable nature.

Operator demonstrates power supply and equipment for making ionization tests on distribution transformers.

Complete instructions for proper operation of equipment should be contained in the manual. Although it will seldom be necessary to refer to the manual for operation of the equipment, information should be included to protect equipment from misuse. It should be noted that suppliers in general should be quite willing to supply this information to insure best possible performance from their equipment.

Instructions for operation of the equipment should be in a form easily understood by persons not specifically trained or familiar with the equipment and, of course, should include complete descriptions of terms used either in the manual or on the equipment which could be misunderstood.

Maintenance instructions become increasingly difficult to specify as the equipment increases in complexity. All circuit theory and applications should be explained in a language capable of being understood by personnel servicing the equipment. In an industrial plant, maintenance of complex equipment, including electronic and advanced circuitry, poses quite serious problems because most manufacturing equipment requires only routine circuit maintenance. Often, personnel are not properly qualified to service complex equipment and the importance of very thorough circuit explanations is magnified greatly.

A complete preventive maintenance program should be outlined. This program should consider limitations of allowable downtime and qualifications of servicing personnel previously mentioned under equipment protection. It should be the responsibility of the supplier to inform

the purchaser if any unusual preventive maintenance is required. The preventive maintenance program should include routine inspection and replacement of limited life components.

Probably the most used tool found in any instruction manual is the schematic diagram of the electrical circuitry. Since a schematic diagram may be drawn in a number of different ways it is necessary to specify the type of schematic desired. A number of standards are available for use as guides with one of the more prominent being the J.I.C. Standards, which contains standard electrical symbols and an illustrative schematic diagram.

Standardization of symbols and types of drawings greatly simplifies the servicing of the equipment and is normally well worth the small additional investment involved. Since the schematic diagram generally receives considerable use and is a necessity in maintaining the equipment, it is wise to secure either a substantial number of prints or a reproducible copy of the schematic.

Also very useful in maintenance is a suggested spare parts list. This list will likely vary with the importance of the equipment. These lists are not difficult to formulate, with the exception of specialized components, and often the user chooses to compile his own lists. In either case, a list should be provided and kept on file.

A list of common failures anticipated in the equipment, together with characteristic effects produced by such failures, and remedial action necessary, often proves to be a valuable tool when servicing equipment with which the servicing personnel are not familiar.

Customer inspection and acceptance should be spelled out in the specifications and/or the contract. This simplifies the problem of inspection at the time of delivery. It is generally wise, especially if the purchaser is not intimately familiar with the quality of the supplier's work, to inspect the equipment prior to delivery. This is especially true if the equipment poses a transportation problem, or if delivery delays are important. These inspections should include, if at all possible, actual operation of the equipment as it will be used in production.

Complete and careful inspection of the equipment prior to delivery will greatly minimize the "debugging" of the equipment at installation. When the equipment is of a nature as to be part of an integral system, complete inspection of the equipment is obviously impossible unless temporary setups can be made. In such cases it is often desirable to arrange for the supplier to be present for "debugging" in the customer's plant, if this is desirable it should be specified in the initial specifications, as this will undoubtedly affect the cost.

Before the equipment is delivered it is generally wise for the supplier and the customer to review the original specifications together. This often brings out incidental oversights which, although quite conceivably do not affect the operation of the equipment, must bear some importance or they would not have been specified.

Before final inspection is performed, the engineer should insist that the equipment be 100 per cent complete as per specifications. Suppliers occasionally request final inspections prior to complete refinement, especially when they are behind schedule.

Crating and means of delivery of a piece of equipment should be specified if the equipment is of a nature which requires special handling because of instrumentation or other delicate components. If the equipment requires adjustment at installation and the supplier is located geographically near the purchaser, it often is most convenient for the supplier to personally deliver and adjust the equipment.

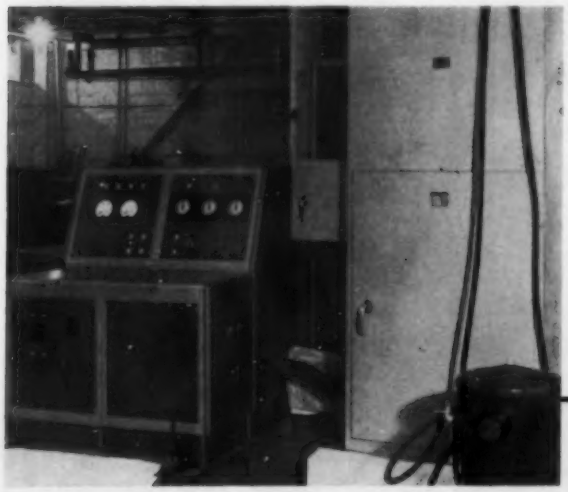
Choose Supplier With Care

Choice of suppliers amounts to much more than choosing the low bidder in most cases. Suppliers capable of supplying equipment of the caliber desired are often extremely difficult to locate. It is also difficult to judge the capabilities of suppliers who have not previously supplied equipment of this nature to the customer and as a result engineers are often hesitant to approve new suppliers.

As in most situations, experience is usually the best teacher in the choice of suppliers; however, certain rules to be followed together with a good set of specifications usually serve to protect customers from incapable suppliers. One of the most important rules to follow, especially with new suppliers, is customer approval of design before manufacture of equipment is begun. It is also important that such design approval on the part of the buyer is not construed by the seller to mean that the buyer assumes design responsibility.

Names of suppliers, their locations and their abilities often are not publicized, especially if their operation is one of a specialized nature, and as a result they are often difficult to locate. Component distributors can often be an asset, especially in locating suppliers in the immediate geographical area.

Many suppliers, particularly suppliers of small special purpose controls and test sets, are unaware of the problems and considerations involved when equipment is placed in a production line operation. It is unwise for the engineer to assume that a supplier will appreciate these problems if he is not made fully aware of them. It is expensive to prepare complete specifications for equipment, but experience has shown that the investment is essential if a quality piece of equipment capable of doing the required operation is to be obtained. **End**



This special test console and power supply, at right, checks circuit breakers in distribution transformers.

Storage Problem Solved By Fork Truck With a High Reach

A FORK TRUCK equipped with one of the highest uprights ever built for a production model enables Parrish-Alford Fence & Machine Company, Inc., Rock Falls, Ill., to fully utilize floor-to-ceiling storage capacity of a new high-bay warehouse.

The special Clark Utilitruc high-lift truck can tier loads weighing 2000 lb as high as 31 ft, 3 in. Warehouse bays are 32 ft high.

Parrish-Alford, a subsidiary of Northwestern Steel & Wire Company, Sterling, Ill., benefits in several ways from the new warehouse and storage technique. The plant can now work three shifts per day, five days a week to build up inventory for anticipated seasonal orders. Formerly the plant was forced to operate six and seven days a week during rush periods due to lack of storage space for finished products.

Here is how the company makes the most of its storage space. In the plant, which adjoins the warehouse, rolls of reinforcing wire are loaded onto custom-built carts as they come off the production line. These carriers handle up to 40 rolls positioned horizontally, depending on the gage of the wire.

The carts are heavy channel-iron frames supported by wheels at one end and metal legs at the other. Another fork truck has been modified to haul carts to the warehouse by means of a towing pin installed on the fork carriage. The towing pin is raised to engage and lift the carts at the end supported by legs. The truck is operated in reverse to tow the carts.

Once the carts are spotted in the vicinity of the proper storage bay in the new warehouse, the high-lift fork truck picks up either four or five rolls of reinforcing wire on the 48-in. long multiple forks which fit into the core of the rolls.

Other rolls are then positioned on this base in pyramid fashion by one worker. Smaller rolls are stacked in a 5-4-3-2 pattern to form a unit load of 14 rolls. Larger rolls are stacked in a 4-3-2-1 pattern.

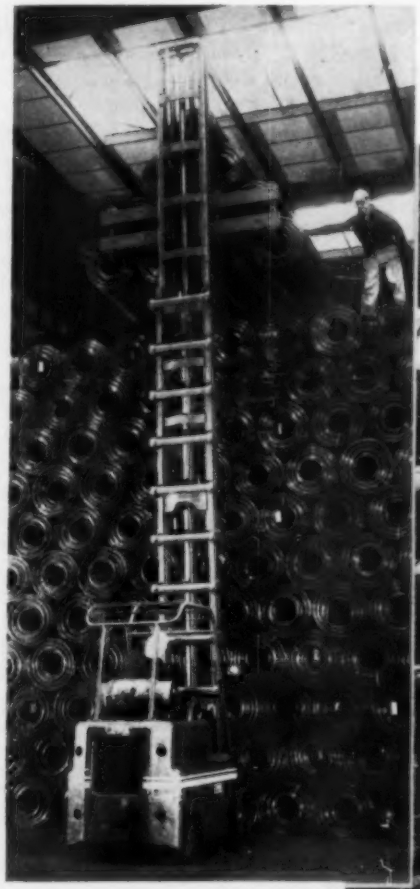
Unit loads are moved to the storage bay by the truck with the load raised just sufficiently to clear the floor. At the proper storage bay, the truck is positioned and then the unit load is elevated into place atop the storage pile.

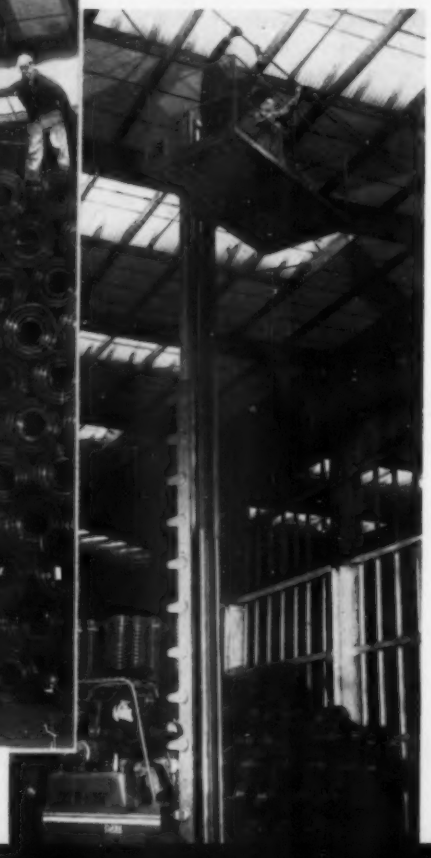
When the load has been elevated, the top layers are rolled off by one man spotted on top of the pile. Forks are withdrawn from the bottom layer of rolls, and the storage pile is leveled off.

The high-lift truck is also used to handle palletized loads of welded wire fencing. Rolls of fencing are palletized as they come off the production line. Pallets are taken to the warehouse by lift trucks equipped with conventional forks and are stacked three high.

The high-lift truck handles two of the 54-in. square pallets at a time and tiers these loads. This truck will also be used to lift pallets to a balcony the company plans to add above two ground-level rail tracks in the warehouse. A conventional fork truck will operate on the balcony to distribute loads placed there by the high-lift truck.

(Continued on page 228)





Left: Truck is equipped with special high-lift upright which can stack rolls as high as 31 ft.

Below: In addition to materials handling chores, truck was also used to assist the construction crews in doing overhead work.

B. GENERAL WORK—PART III MASONRY

CONSTRUCTION SPECIFICATIONS

By R. E. WALLIN, Chief Engineer, Construction, Plant Engineering Dept., Joseph T. Ryerson & Son, Inc.

MASONRY WORK

MATERIALS. The required face brick is generally specified as being of first-quality, hard-burned clay as selected by the engineer.

The contractor should be asked to include in his contract price a specified lump sum amount, based on a set price per thousand, for the purchase of the face brick f.o.b. the building site. Should the selected brick differ in price from the pegged price, then the contract amount will be adjusted up or down by the difference between the specified lump sum price and the actual expenditure.

Common brick should also be specified, especially if there is any choice in the area or if it must be brought in from other areas.

Any structural clay tile for fireproofing, backup, plastered partitions or finished partitions should meet A.S.T.M. serial designation.

Concrete masonry units (generally marked as concrete blocks on the drawings) should conform with A.S.T.M. serial designation.

Ceramic glazed clay tile and concrete masonry units are usually detailed on the drawings, and sizes specified as modular with dimensions given for depth, height, and length. Ceramic glazed-face structural tile should also be specified for grade, color, and finish.

Masonry unit surfaces which will be exposed and painted on the interior of the building should be selected for smooth faces and ends and be free of chipped corners and edges. In some areas these surfaces are ground to give smoothness.

Stone for trim, sills, and copings should be requested as being first-quality, even grained, and uniformly colored as selected by the engineer.

Granite is a good product for the main entrance sill and other sills and jambs which get heavy wear.

The kind of flue lining to be used should be outlined.

Mortar for masonry work can be specified in different ways. It can be made of pressure-hydrated dolomitic lime, portland cement, and sand in specified proportions of each according to the experience of the architect. It can be made of commercially bagged mortar mix and sand. Whichever is used, mortar should be uniformly and well mixed and used immediately after mixing.

Masonry is only as good as the units and mortar which are used to lay it up. The best is the cheapest over the years. It costs as much to lay up the poorest quality as it does to lay up the highest quality units. This is an area where care should be exercised to get the best.

Parapet walls and coping above them, as well as window and door sills, always present a maintenance problem. There are numerous products which can be used, but cut stone has been favored through the years.

Membrane laid under coping and sill stones is a good investment for keeping moisture out of the masonry below. This membrane should be extended ¼ to ¾ in. to bring drip beyond both faces of the wall. Plastic membrane is now being used for this purpose, as well as the traditional copper-asphalt type.

Butt joints of stone coping and continuous sills should be caulked outside of the mortar. Premolded lead type caulk is especially good.

SAMPLES. Stone, face brick, and structural tile samples should be submitted for approval.

As a rule, stone samples are two pieces, 12 in. by 12 in. by 2 in., showing texture and extremes of color (light and dark).

LAYING OF BRICK AND CONCRETE BLOCK. Face brick should be laid in level, uniform courses, to the bond pattern specified by the architect, spaced with a story rod. Normally, face brick is laid up in "common" bond, where vertical joints are staggered and centered on stretchers immediately above and below, and every sixth course is a continuous header course. Brick should be

Fig. 1. Good specifications are important to good work. Here, correctly mixed mortar, applied properly, produces this result when brick is lifted from newly-laid wall.

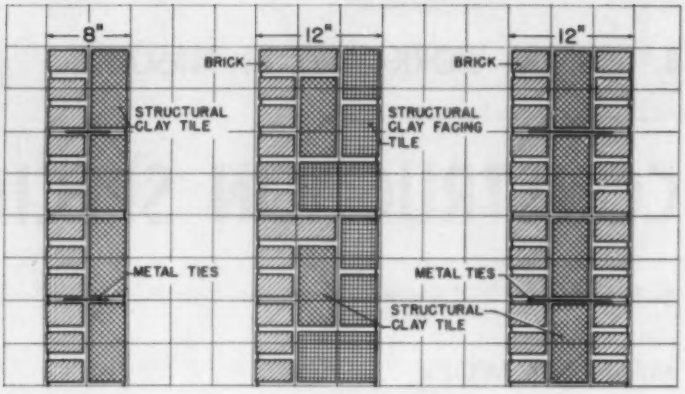


Fig. 2. These are indicative of the several ways in which combinations of brick and structural clay tile can be laid in walls of varying thicknesses.

CONSTRUCTION SPECIFICATIONS

laid in full mortar beds with filled end joints and with mortar filled in between face brick and common brick and between face brick and backup material. Stretchers expose the edge; headers expose the end of the brick.

Interior partitions made of lightweight masonry units or concrete blocks are becoming more and more popular because they can be finished by merely painting. These masonry units, as well as ceramic glazed tile units, are normally laid in level courses with vertical joints staggered or in line, but there are many new patterns being developed by architects which are very attractive. Jointing must be such as to give a neat and symmetrical appearance and to avoid exceptionally small units.

Units should be cut with an abrasive circular disc.

Full beds of mortar and filling of all vertical joints should be specified. Exposed joints generally look best when concave rodded.

SETTING GLAZED STRUCTURAL TILE. Ceramic glazed, full or cut, tile, as well as facing units or soaps, should be laid up in shapes and sizes shown on the drawings or as required to give a complete and proper installation.

Generally, external corners, including those at caps, heads, jambs, etc., are specified to be bull-nose, and internal corners angular or square. Mitered corners shall be provided as required. Special shapes should be provided where necessary to avoid any exposed unglazed portion of tile.

Units should be set level and true to line and without wind across the face of the wall in full beds of mortar with joints as detailed by the architect. Faces of units must be kept free of mortar.

It is important that units be carefully cut around electrical outlets, piping of all kinds, and fixtures.

Full units of the proper size are to be used wherever possible, and units containing surface defects or chipped edges must not be laid in the wall.

SETTING CUT STONE. This work must be done by competent stonesetters.

All stone should be cut to dimensions shown on the drawings, with perfectly true and level beds, without ridges or depressions, and with absolutely vertical joints. Faces of stone must be absolutely true and out of wind.

Shop drawings showing all cutting details, jointing, setting, and anchorage for the work must be approved before any stone is cut.

Stone stains easily and should be stored at the building site on planking set so that stone will rest entirely clear of the ground. It should also be protected by proper means from damage to the surfaces, especially those which will be exposed, and from contact with anything which would result in accumulation of dirt, dust, or staining or disfiguring of the stone. The full responsibility for protection of the stone from damage or injury must rest with the mason contractor, who is generally required to replace, at his own expense, all stone that is spoiled or defaced prior to final acceptance of the work.

Through-wall flashing for under stone coping and sills is generally furnished and installed by this contractor.

WEATHER PROTECTION. When masonry work is laid up at temperatures below 40 F, the brick, sand, and water should be heated.

The mason contractor must assume full responsibility for the protection of his work against damage from rain, frost, or freezing, and should provide and maintain suitable housing, covering, temporary heat, and such other procedures as may be required to protect the work at all times during day or night.

At the completion of each day's work, the tops of all walls exposed to the weather should be securely and adequately covered, and the tops of all completed brick construction must be fully protected against rain and moisture until sills, flashing, coping, etc., are laid to give permanent protection.

CLEANING AND POINTING OF MASONRY, ETC. After work is completed, exposed surfaces of finished masonry should be thoroughly cleaned to remove all mortar, dirt, paint spots, etc. Joints should be pointed up during this tuckpointing process.

Generally, only clear water, soap, and sand should be used for cleaning. To remove stains, a solution of acid and water may be used. Surfaces must be thoroughly flushed with clean water after acid cleaning.

All cutting and patching of masonry required for other trades is to be done under this section. Chases, reglets, etc., should be left free of mortar and debris. Unless otherwise specified or shown, the spaces around built-in items to be filled solidly with masonry. **End, Part III**

Next month, the author will detail the specifications that should be written for another of the construction trades —carpentry. This section will include millwork and hardware, and how it should be specified.

WATER HAMMER TROUBLES?

Remedies Depend Upon Media, Needs

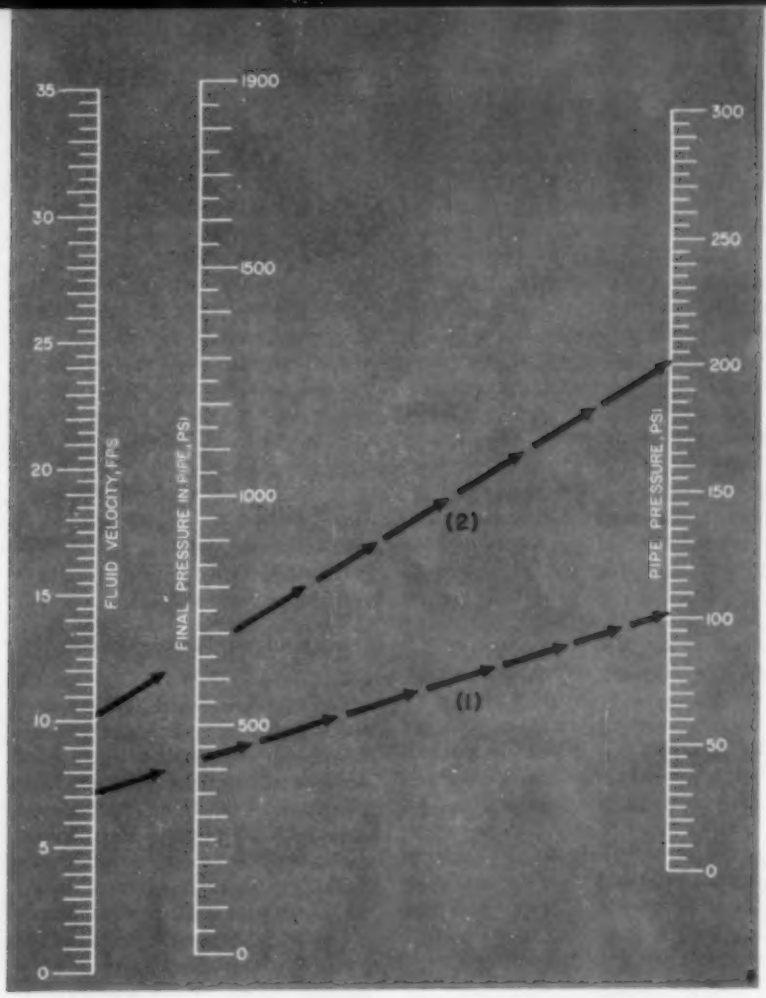


Fig. 1. Nomogram for computing approximate final pressure during water hammer in industrial pipes. Line (1) solves the problem mentioned in text; line (2) shows the final pressure in a 200-psi system when velocity is 10 fps.

By **SANFORD C. BENNETT**, Plant Engineer
American Technical Company, Merrick, N. Y.

TOO MANY industrial plants allow water hammer to damage valuable piping and process equipment. Besides the expensive loss of a valve, trap, length of pipe, or a gasket, water hammer increases maintenance costs, causes unnecessary shutdown of production units and is a severe annoyance to employees whose jobs require concentration on their work. Water hammer can be a serious threat to all industrial plants using any kind of fluid. You can kill this threat if you know a few simple facts about water hammer causes and the best cures.

First, what is it? Water hammer is the pressure rise which is caused by sudden stoppage of water flow through a pipe. The stoppage may be complete or partial, depending on what causes it. Hammering can occur in pipes conveying hot or cold water, a mixture of steam and water, and in lines handling other fluids such as oil, acid, chemicals, air, etc. However, since hammer in water and steam lines is the most common trouble met today, we'll devote most of our space to it.

Water hammer is met in steam heating systems, water pumping lines, condensate return lines from process equipment, compressed-air piping and elsewhere. It is easily identified by the loud slamming sound heard in severe cases and by the hardly audible movement of water in mild cases.

When the hammering is severe the pipe may vibrate with each pressure rise. Eventually gaskets may be blown from between flanges, pipe elbows or valve bodies may be cracked, and equipment such as kettles, rolls and tanks may be damaged.

Water hammer occurs in steam lines when steam, traveling at 70 to 80 mph, forms waves in the condensate lying on the bottom of the pipe. The waves become higher until finally a short slug of water fills the entire pipe. Since the fast-moving steam cannot be stopped it pushes the slug of water through the pipe at high velocity until the slug meets a complete or partial obstruction such as a closed valve, an elbow or tee. The water is slammed against the fitting and is momentarily stopped.

Since a slug may weigh several

pounds or more, the resulting impact can be enough to cause serious damage. The characteristic sound of water hammer is produced by the slug hitting the valve or fitting. Of course more than one slug of condensate can be pushed along by the steam. Then the sound is nearly continuous.

When water or another fluid fills a pipe, such as a pump suction or a discharge line, water hammer takes place in a somewhat different manner. Suppose we have a pump discharge line or a city water line supplying process kettles. If a valve at the kettle is suddenly closed when water is flowing through the pipe there is complete stoppage of flow at the valve as soon as it is seated. However, water that is traveling towards the valve continues to move for a short time. While this water is being brought to rest there is a sharp rise in pipeline pressure.

Maximum pressure does not occur at the valve, but its effects may occur nearby because that is the first place the pressure acts. The pressure wave travels very rapidly; in 2- to 6-in. cast-iron pipes the wave travels about 4200 fps.

Pressure Rise Is Important

Though the speed of the pressure wave is of some importance, the item of greatest interest to the plant engineer is the pressure rise which takes place. Since much industrial piping is used to convey water at pressures of 100 psi or less, an example showing the final total pressure occuring with water hammer is instructive:

For every foot per second of halted velocity the pressure rise is about 45 psi in usual industrial pipes.

Thus, with a velocity of 7 fps before the valve is closed, the pressure rise immediately after closing is about $7(45) = 315$ psi. The total pressure in the pipe at any time during water hammer is the sum of the pressure surge and the normal pressure in the pipe. If this pipe normally conveyed water at 100 psi, the maximum pressure which might occur is $315 + 100 = 415$ psi. See Fig. 1. Thus, if pipe and valves had been chosen for a maximum pressure of 300 psi, rupture of pipe or breakage of the valve might occur. Of course, much depends on the factor of safety used in the system design.

The simple water hammer described dies out quickly because the pressure wave reverses and travels to the opposite end of the pipe. This is repeated many times and with each reversal the pressure in the pipe decreases until the normal value is once again reached. However, where the main line has one or more branch pipes, as is often the case, the maximum pressure that occurs in the line can become considerably higher than that computed above.

Branch Lines Cause Trouble

For instance, with a branch that is closed, either by a valve, plug, or cap, the pressure caused by water hammer in this part may be almost double that in the main line. If the backwave from the branch enters another closed branch the final pressure may be four or more times greater than in the main pipe. That is why intricate industrial pipelines are far more susceptible to water hammer than simple straight pipes. Unfortunately, the pipeline with a number of branches is more common than the simple straight type.

What happens when we close a valve slowly? For every foot per second of velocity lost we have a similar rise in pressure as when a valve is suddenly closed. Thus, if we reduce water velocity from 9 to 4 fps the pressure built up is $45\ (9\text{-}4) = 225$ psi. However, with slow closing of the valve there is often sufficient time for the pressure wave to dissipate itself gradually without an excessive pressure increase. This is the main reason for using slow closing valves on long industrial pipelines and in places where inexperienced personnel have to operate the valves.

Since water hammer remedies are simple to apply, you can stop the condition faster if you know where to look for it. Experience shows that you should suspect the following types of pipe:

1. Pump suction and discharge lines. Water hammer in these pipes can be quite tricky. In a case recently investigated, the suction and discharge lines were examined after a valve had been cracked by hammer in the discharge line. The lines had been correctly installed and fitted with suitable safety devices. During the day, while the plant was in full production, there was a power failure in the local utility. All pumps in the plant stopped at the same instant. There was severe hammer and a valve in one pipe cracked. The investigation showed that the relief valve fitted to this pipe had failed to work at the proper time, resulting in the valve failure.

2. Poorly drained steam, compressed air, gas, and similar pipes often have water hammer. Figure 2 shows the correct way to connect drains to pipes and equipment conveying steam or gases from which moisture may condense.

3. Pipes fitted with quick-closing cocks and valves may develop water hammer when persons unfamiliar with plant operation manipulate the valves. Places where this can occur are in vats, tanks, kettles and like equipment which are filled through manually-operated valves.

4. Deepwell pumps of the turbine type may be damaged when suddenly stopped because pressure in the discharge pipe reverses.

5. Any pipe in which large quantities of air can accumulate or in which the pressure may fall below atmospheric may have water hammer.

There are a number of ways to cure water hammer. Some are expensive; others cost little. The method you select depends much upon your needs. For example, if the piping is low-cost and your only concern is adequate protection of the pipe, you can probably use moderate-priced equipment and secure excellent results.

Let Situation Justify Cost

If it is necessary to protect one or more pumps and expensive piping, more reliable equipment must be used. If noise elimination is required along with protection of process equipment, pumps and pipes, then you are entirely justified in going to elaborate protective units. In any case, the cost is seldom excessive.

Where water velocity is low, say less than two feet per second, and

the pipe is short, less than 1000 ft, no protection is needed in most cases. This is because the pressure rise normally will not be sufficient to damage piping or equipment. But few, if any, industrial pipes have fluid velocities of less than two feet per second.

Pump Stoppage Relief

If water velocity is high, 2 to 10 fpm, or there is danger of sudden stoppage of one or more pumps, excess pressure caused by water hammer can be relieved by spilling to an emergency tank or the sewer. An alternative remedy is lengthening the flow-stopping time to an appreciable interval.

Means of accomplishing the first alternative include slow-closing check valves at the pump, relief valves, and use of properly sized and installed steam traps. Time interval of the pressure rise, the second alternative, can be increased by fitting pumps with flywheels, use of air chambers, air aspiration, air injection and air valves. The latter also spill water.

Hydraulically-operated relief or safety valves provide good protection for lines conveying water and other fluids, if the valves are kept in good working order. Since these valves relieve pressure by permitting the pipe contents to flow to the sewer or another tank, additional piping is needed with them. Where the pipe conveys costly fluids or dangerous fluids, a tank is needed to prevent unnecessary waste or damage to plant equipment.

Hydraulically-operated relief valves suitable for many fluids are available from different manufacturers. Their cost is low. When using valves of this type be sure that they are in good condition at all times.

Corrosion of valve parts, wrong adjustments of hydraulic parts or excessive wear may prevent the valve from working when it is needed most. Follow manufacturer's instructions for installation.

In general you'll find that spring-loaded relief valves will do as fast a job as hydraulically-operated valves because the former tend to open rapidly. In addition they are easy to maintain periodically and keep in good working order.

Slow-closing check valves do not operate as soon as there is reversal of flow in a pipe. There is a definite pause before they operate. During this time high-pressure fluid can pass back through the valve to the low-pressure side of the system. Of course there must be a reservoir of some sort on the low-pressure side to receive the fluid.

These valves are often used on the discharge side of centrifugal pumps. Ordinarily they will protect pipes up to 3000 ft long. Where longer pipes must be protected, some other form of relief device should be used because a slow-closing check for these lengths must be open so long before closing that backflow through the pumps in the system may damage them.

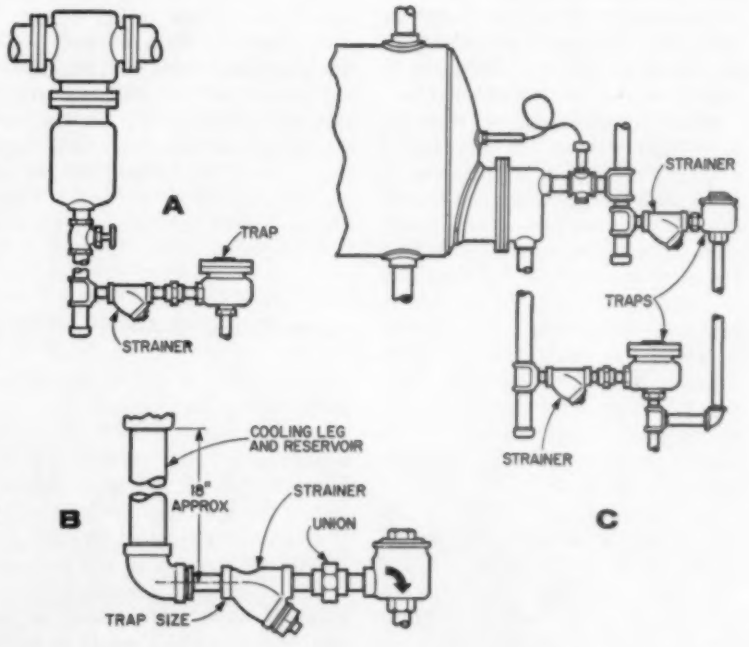
One method of pipe protection for systems having electrically-driven pumps uses a solenoid valve to relieve excess pressure. As was noted earlier, water hammer can occur when a number of pumps stop at the same time, no matter what the cause. So if you wire a normally-closed solenoid valve into the power circuit of a pump driving motor, the valve will open when current failure stops the pump. Excess pressure will be relieved by the valve as long as current does not flow to the motor.

Piping connections for the valve are simple. All you need do is tap a small line into the side of the main pipe. The solenoid valve is mounted in the small pipe, a foot or so from the main pipe.

To provide double protection, a pressure switch set to actuate the solenoid valve may also be connected to the main pipe. Then the solenoid relieves excess pressure when the pump fails or when water hammer from other causes starts. Pipe the solenoid-valve discharge to a tank or the sewer, depending on the type of fluid conveyed.

Steam and Air Lines, Too

Hammer in steam and air lines can cause just as much—and sometimes more—trouble as it can in water pipes. Traps are the best and most economical devices for preventing



Courtesy W. H. Nicholson & Co.

Fig. 2. Suggestions for connecting drains to pipes and equipment conveying steam or gases from which moisture may condense: (A) Proper connection of a steam trap and drip leg, (B) reservoir and cooling leg precede the strainer inlet, (C) correct trap installation on a water heater.

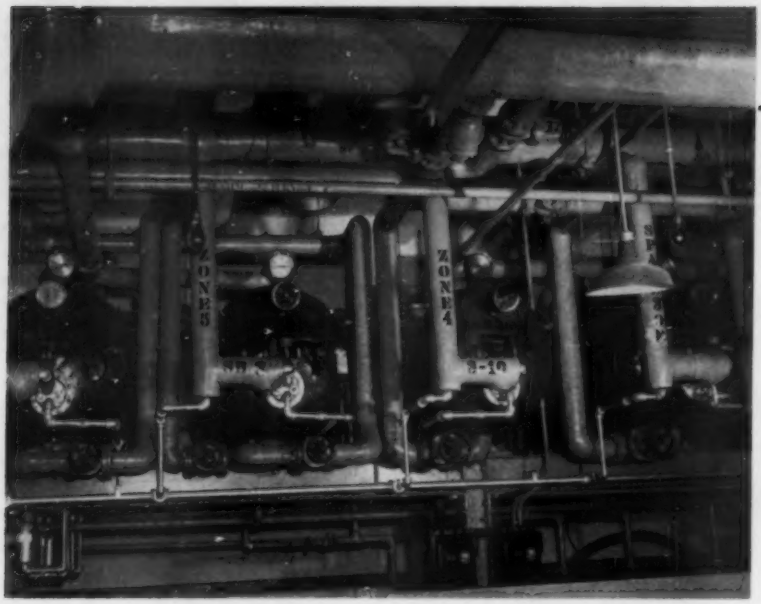


Fig. 3. To eliminate water hammer, properly drain steam lines, heaters.

WATER HAMMER TROUBLES?

water hammer in steam and air lines. However, moisture separators also help remove water from steam, reducing the possibility of hammer.

There are a number of ways to connect steam and air traps to insure adequate drainage of water. Remember, you can have a good trap of proper capacity connected to a steam line and still get water hammer if the connection is not correctly made. So, when putting in new traps or relocating old ones, if you're in doubt, write to the manufacturer.

Many industrial plants now use centrifugal pumps for handling a variety of fluids. These units can be fitted with flywheels which will keep the pump turning for several minutes after a power or electrical failure. However, flywheel cost and the power loss associated with its use usually rule it out today. But where a system is extremely susceptible to water hammer and other remedies have failed, a flywheel will often save more than it costs. Keep that fact in mind when a puzzling water hammer problem crops up again.

Flywheels are often used on certain types of reciprocating pumps. So when you are looking for a unit of this type, remember that the flywheel-fitted pump may be a better buy if water hammer is likely.

Air chambers are cylindrical vessels fitted to the suction and discharge lines of various types of pumps. They prevent water hammer by storing air which can be compressed by a pressure surge like that which occurs during hammer.

Like flywheels, the cost of an air chamber may discourage its use. They must be kept perfectly tight to prevent air leakage during operation. If they aren't, they are almost useless in the average piping system.

Air chambers are most easily justified in systems fitted with reciprocating pumps because they serve two purposes—they smooth out the normal pulsations associated with these pumps and they relieve the excess pressure of water hammer. Their use in centrifugal-pump systems is very limited.

Protection with Air

Air aspiration and injection are methods of protection used for water or other lines conveying fluids. They depend on the fact that when a pump first fails there is a drop in pressure before the first high-pressure surge. If air can be introduced into the pipe during this moment of low pressure, it will prevent an immediate return surge of water. Also, some of the moving water which would normally reverse its direction of motion and cause hammer, continues to flow to the end of the pipe and discharges at its normal destination.

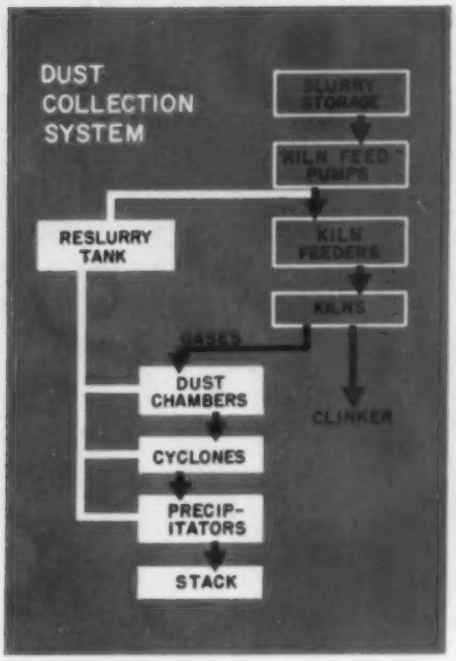
In the air aspiration method, two or more check valves are connected to the pump discharge and suction lines by small-diameter pipes. When the pressure in the main pipe falls below atmospheric, the check valves open inward to admit air. While air is entering the pipe, the water continues to flow away from the pump. When air pressure in the pipe reaches atmospheric, the check valves close and the water reverses its flow, but the pressure built up is far below that which would occur without air in the pipe. Also, the trapped air cushions the reverse flow, eliminating the possibility of dangerous pressures.

This system is especially useful with long, flat, water and other fluid lines. Always install more than one air check valve on each side of the pump so air can still be admitted if one valve fails.

On certain types of systems it may be advisable to introduce air at pressure when the pump fails. When an air compressor is used for this purpose the system is said to be protected by air-injection. Air pressure used is about 10 psi below pump discharge pressure. Use a small air tank to hold a reserve supply of air. The system operates much like the air-aspiration method described above.

Air valves open to admit air just as check valves do in air aspiration but they also release water during the return high-pressure surge. Special units are available from a number of manufacturers. Be sure to locate these valves indoors where they will not freeze in winter.

No matter what method you use to prevent water hammer in your plant you are certain to have better production, more dependable water, steam and other process-fluid supply, and fewer pipe and equipment failures. Water hammer cures are low cost but they often pay for themselves many times over. So do not neglect water hammer; get to work on it today and banish it from your plant. It's well worth the time and effort. **End**



FINES RECOVERY PROGRAM SAVES $125,000 ANNUALLY

Many special features have been incorporated in this electrostatic precipitator installation for recovering lithium aluminate

TWO ELECTROSTATIC precipitators are reclaiming up to $125,000 worth of lithium aluminate annually at Foote Mineral's ore extraction plant in Sunbright, Va.

For a time the relatively new plant operated without the precipitators, with a loss of 54 tons of product per day with two-kiln operation. This is now reclaimed and fed back to the process.

The installation consists of two precipitator units, each serving a 10 by 340 ft rotary kiln. Exhaust gases from the kilns first pass through dust chambers and cyclone collectors before entering the precipitators. See the flow diagram on this page.

On entering the precipitator, the remaining dust particles receive a high electrical charge, collect on grounded plates, and are then shaken into hoppers. Average precipitator efficiency is 97.5 per cent.

The two outdoor precipitators, supplied by the Buell Engineering Co., Inc., New York, N. Y., are so installed that each unit serves a kiln. Suitable ducting permits diversion of all gases through either precipitator to permit continued kiln operations during maintenance on one unit.

Precipitators are located side by side and insulated as one unit, a common wall separating the two units. This eliminates one wall and the insulation of two walls, as would be required with two separate units.

Each precipitator has four hoppers in series to collect dust removed from the exhaust stream. Each group of hoppers discharges continuously into its own screw conveyor, the two conveyors feeding into a third conveyor, Fig. 1, which carries the lithium aluminate back to the process. Hoppers are equipped with vibrators and are insulated to prevent moisture from condensing and wetting the reclaimed dust.

The collector is equipped with an audible alarm which sounds off should either of the two feeder conveyors or the main conveyor become inoperative, or should a short occur in the precipitator. If a conveyor is out of order, equipment preceding the disabled unit automatically stops, to prevent dust pileup in the system.

If a short has occurred, the precipitator automatically shuts off. A short could be caused by a buildup of dust between the emitting electrode wires and collecting electrode plates, or conceivably by a slack or broken emitting electrode contacting a collecting plate.

The precipitator automatically restarts itself in event of a short, and only if on the third try, or "recycle", does the alarm sound if the shutdown persists. When the alarm sounds, a pilot light indicates whether the trouble is with a conveyor or due to a short. The alarm must be turned off before restarting.

Precipitator transformer - rectifiers were designed to step up 440-v a-c supply voltage as high as 66 kv and then convert it to d-c. Normal operating voltage, however, is 45 v. The transformer-rectifiers, one for each precipitator unit, are located on the roofs of the precipitators. See Fig. 2.

Also shown in Fig. 2 is the horizon-

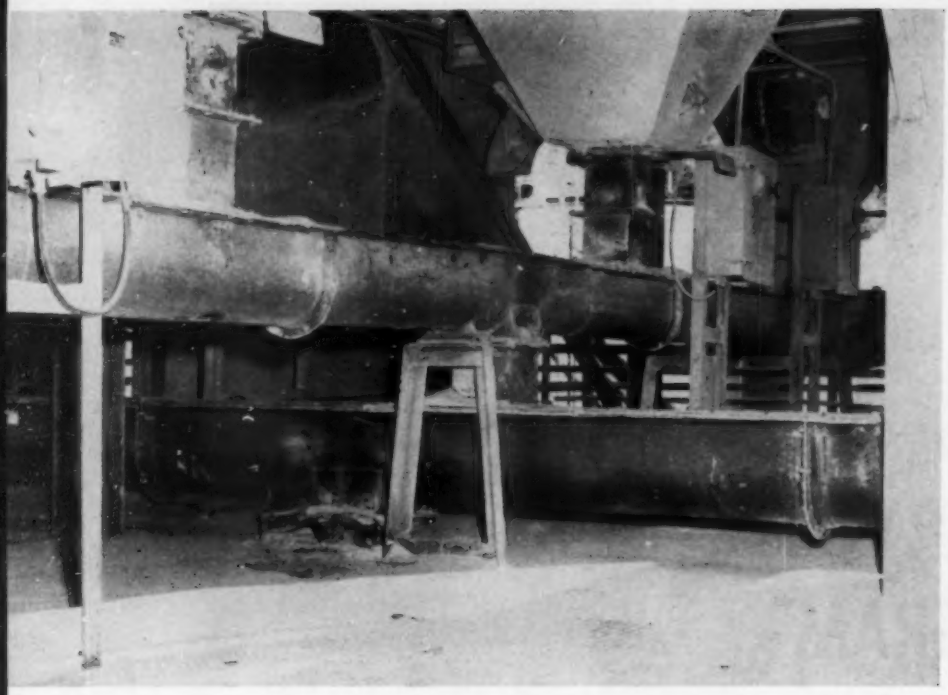


Fig. 1. Feeder conveyors collect dust from precipitator hoppers and deliver it to a main conveyor for return to the process. Hoppers are insulated to prevent condensation and moistening of collected dust. Vibrators prevent dust buildup in hoppers.

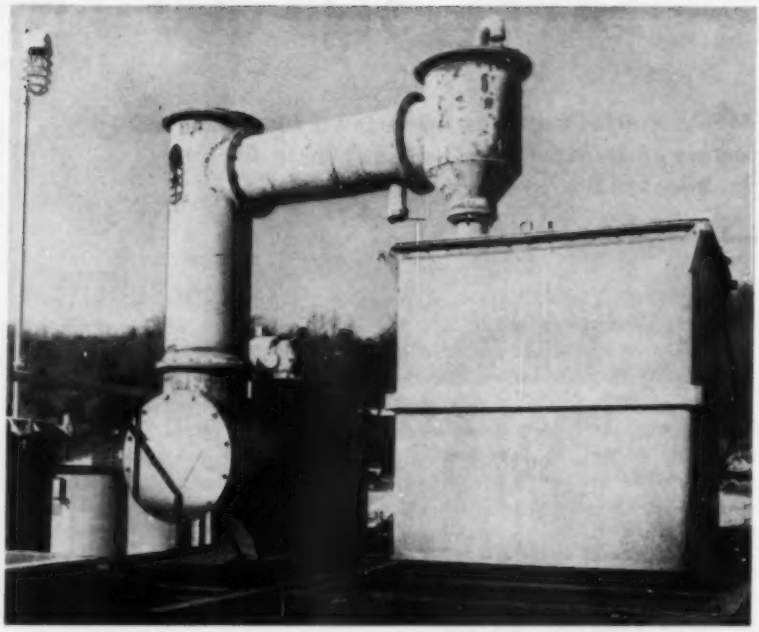


Fig. 2. Transformer rectifier tanks, one for each precipitator unit, are located on the roofs above each precipitator. This locates them close to the emitting-frame terminals and yet they are in a safe, out-of-the-way area.

RECOVERY PROGRAM

tal guard carrying the high-voltage conductor from the rectifier to the emitting-frame terminal, which is enclosed in a cylindrical housing. The high-voltage conductor is merely a length of steel pipe, this being a highly practical conductor for the high voltages and low currents involved.

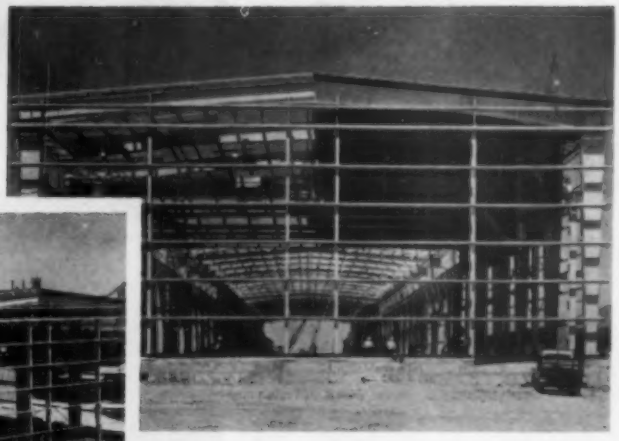
The rectifier cover cannot be removed while the main power supply is connected. A key interlock system necessitates release of the cover with a key, and this key can only be removed from its keyblock by means of a master key normally in its lock on the control panel. When the master key is removed from its lock, the main power supply is off. Power cannot be resumed until the master key is returned to the control panel, and this necessitates replacement of the rectifier cover and return of the cover key to its keyblock.

Controls for the precipitators are housed in a separate building near the precipitators. Much of the control equipment for major plant facilities is located in this building.

Each control panel has a master disconnect switch, voltage regulator, master key, and on-off controls for the transformer, rectifier-tube filament, electrode rapper-motors, and heaters which prevent condensation on high-voltage terminals. Also included on each panel are pilot lights indicating whether the stop-start buttons are on or off. Alarm lights are included on one of the panels, as is the pushbutton for acknowledging an alarm before restarting.

Foote Mineral checks its precipitator performance monthly. Recent tests indicate a loss of about 0.4 to 0.5 ton per day stack loss. Gas temperatures range from 475 to 520 F and gas volume is approximately 73,500 cfm per kiln. **End**

STEEL MAKER "STRESSES" RIGID FRAME DESIGN



Rigid frame building built for steel mill application features continuity of structure that increases loading capacity. Trussless construction required extensive use of steel plate.

A BUILDING recently completed in Hamilton, Ontario, houses the continuous galvanizing and aluminizing lines of The Steel Company of Canada. The building incorporates rigid frame design with heavy crane loadings up to 50 tons. The use of "Z" section cold-formed purlins and tapered sections for the rigid frame in this 1200-ft-long building is a departure from traditional mill building design with trusses and heavy rolled sections.

The owners chose this design for two primary reasons. First, the use of rigid frames fabricated from plate and the use of cold-formed high tensile steel purlins and girts saved considerable weight. Secondly, this design allowed the use of about 2400 tons of plate (which the owners manufacture).

The total area is 222,500 sq ft; the weight saving involved in the design averaged 5¼ lb per sq ft, compared with a conventional flat truss design. The breakdown for a typical 25-ft bay in one of the 103-ft span aisles is as follows:

Building Component Total Weight	Rolled Sections	Fabricated Sections
Rigid frame without haunched knee	53,500 lb	
Flat truss with columns	41,500 lb	
Rigid frame with tapered members		34,400 lb
Purlin	19 lb per ft	13.6 lb per ft "Z" shaped hi-tensile
Girt	8.2 lb per ft	4.8 lb per ft "Z" shaped hi-tensile

In addition to the initial saving in capital cost, several other advantages have become apparent.

1. All building steel (exclusive of crane runways, monorail systems, machinery platforms and stair towers) was of Canadian manufacture, and its delivery was unaffected by the steel strike in the U. S. at the time of placing the order.

2. The strength built into the frame for one type of loading gives it strength to sustain other loadings, provided they do not occur simultaneously, because of the continuity of the structure. Thus, large monorails used for maintenance purposes—and not anticipated in the original calculations—did not require heavier material in the frames.

3. The building is easy to expand both lengthwise and laterally.

4. Since there is no horizontal bottom chord, the lateral expansion and contraction in the building due to temperature changes can be absorbed by diaphragm action on the roof, the ridge moving up and down to prevent possible overstressing and buckling of the flanges in the outside columns.

5. A neat and functional building with a low eave height and attractive appearance was possible with rigid frame.

Although engineering costs are higher for this type of structure than for a conventional design, the savings in material more than offset them. The design was supervised by Butler Manufacturing Company (Canada) Limited, who supplied the building, and the owners.

The Butler design involved strict control of welding. In addition to that required for the critical tension welds, it was also necessitated by the use of a single fillet weld on one side of the web-to-flange connection of the rigid frame members.

Design of the purlins and girts was made in accordance with the AISI Light Gage Cold Formed Steel Design Specifications as these involved 14-gage and $\frac{3}{16}$-in. material. The crane runways and the remaining parts of the building were designed according to conventional design procedures using A.I.S.C. specifications. **End**

Fig. 1. Small as well as large diesel and gas engines can be air-started.

AIR STARTING CAN PAY OFF

Here's how to determine sizes, clearances, design of receivers and figure air consumption

By **ADOLPH G. RINGER**, Assistant Manager
Pneumatic and Electric Tool Division
Ingersoll-Rand Company, New York City

MANY PLANT engineers are turning to air starting for internal combustion engines on all types of mobile and stationary equipment. The reasons they give for converting to air starting are reduced operating and maintenance costs and elimination of a safety hazard.

Air starting meets safety regulations for spark-free starting systems in hazardous areas. For example, an eastern shipbuilder installed air starting on diesel powered fork lift trucks, Fig. 1, used in their paint plant.

No air reservoir is installed on the material handling trucks. Instead, a quick-opening valve and fast-disconnect coupling quickly attaches the starter to the existing plant air supply line. Hydraulic starting had been tried on one of the lift trucks. Although this also met safety regulations, entirely too much time was required to hand-pump the system.

Conversion to air starting requires little equipment

Displacement	Max. Hp. at 90 psi	Ingersoll-Rand Air Starter Size
Up to 300 cu in., diesel	3	3BM
From 250 to 500 cu in., diesel	5	5BM
From 400 to 2300 cu in., diesel	13	10BM
From 900 to 9000 cu in., diesel	24	20BM
Over 9000 cu in., diesel	24	20BM

[1]If these large engines are presently equipped with electric starters

Table I. Typical examples of air starter sizes for various diesel units.

Table II. Physical factors and performance data for various size motors.

Size	Weight Pounds	Maximum hp			Maximum Torque Foot Pounds			Bendix Pinion Speed at Maximum hp rpm			Cubic Feet of Air Per Start	Inlet Pipe Tap Inches	Size Hose Recom. Inches	Min. Air Receiver Capacity Gal.
Air Pressure at Motor-psi		90	120	150	90	120	150	90	120	150				
3 BM	20	2.5[1]	3[1]	3.4[1]	17.3[1]	19.5[1]	21.6[1]	1610[1]	1670[1]	1720[1]	4	½	½	30
5 BM	35	5.0	7.1	9.2	29	38.5	48	1860	1980	2060	5	¾	¾	30
10 BM	38	13	18.4	23.9	53	71	88	2200	2340	2440	11	1	1	30
20 BM	115 to 177	24	34	44	86 to 205	118 to 272	146 to 340	1010 to 2580	1105 to 2820	1200 to 3050	17	1½	1½	80

[1]For 3BM, air pressures are respectively 80, 90 and 100 psi

alteration. All sizes of air starting motors are interchangeable with electric starters using Bendix drives. Air starters are available for small gasoline engines with as little as 100 cu in. displacement and for large diesel engines (over 9000 cu in.) and gasoline engines (over 20,000 cu in.). See Tables I and II.

The major concern in converting from electric to air starting is mounting clearance. Cross-check typical clearance dimensions carefully for various size air starters (Table III) with a detailed drawing of the engine to be started. There are models in each of the four basic size air starting motors to fit practically any unit that is presently being started electrically through a Bendix drive.

In installations that do not have adequate clearance, it is frequently possible to use the next size smaller air starting motor and raise the system pressure. This is particularly adaptable to stationary installations or in-plant mobile equipment such as fork lift trucks where the plant system supplies air for starting. Naturally, longer life can be expected from the larger of two units operating at a lower pressure than from the smaller unit operating at a higher pressure.

Information Necessary To Complete Spec

Three additional pieces of information are necessary to complete your specification for the exact model air starter required: (1) mounting dimensions of the Bendix housing, (2) mounting dimensions of the Bendix drive, and (3) pinion data, pitch, number of teeth, pitch diameter and outside diameter.

Plant engineers have a great deal of flexibility in designing the air starting system. All necessary components are available commercially, or the system may be fabricated in your plant. The plant engineer at a southern gas company had air receivers fabricated out of 10-ft sections of 10-in. pipe, to start the Climax R-61 gas engines in Fig. 2. With 120 psi air pressure, the engines can be started three times in succession without any possible trouble from these homemade receivers.

I might also mention that any non-corrosive, non-toxic compressed gas can be used with an air starter. Booster stations on gas pipe lines frequently use the compressed gas for starting. Even with a toxic gas, the exhaust of the air starter can be piped to the compressor intake.

Basically, an air starting system consists of a receiver of adequate capacity, a filter, a quick-acting valve and a lubricator. Most starting motors come equipped with built-in lubricators. If built-in lubricators are used, air line lubricators are unnecessary. Small engines such as

Table III. Typical mounting dimensions in inches. Refer to drawing under table for location of measurements.

SIZE	Dimension A	Dimension B	Dimension C
3BM	12⅝	3⅝	3⅛
5BM	15⅝	4⅞	3¼
10BM	17½	4⅞	3¼
20BM	23⅜	5⅜	4⅝

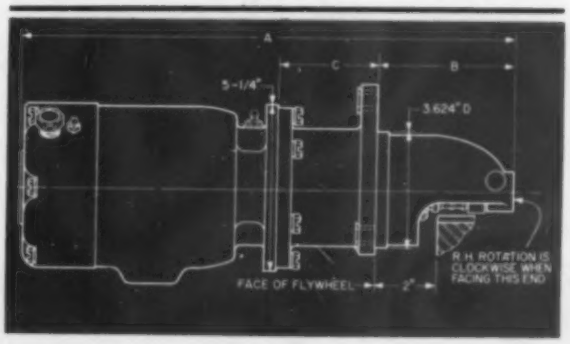


Fig. 2. Air receivers used for starting these engines were fabricated from several lengths of 10-in. pipe.

AIR STARTING CAN PAY OFF

for fork lift trucks can even be started direct from a plant air system, but it is best to insert a receiver at the point of starting to insure an adequate reserve and to prevent reducing the output of other air-operated equipment during heavy start-up periods.

The size of the receiver selected (Table IV) depends on three things: how many times you want to start the engine without recharging the receiver, the available starting pressure and the size of the starting motor. There is no fixed rule on receiver size. However, the more mobile equipment should have the larger reservoirs. A rule of thumb for reservoir capacity is three to five starts. This naturally couples the reservoir size to the cubic feet of air consumed per start (Table II).

Air consumption per start is relatively unaffected by system pressure. Even though air is consumed at a faster rate at higher system pressures, this is accompanied by increased starting horsepower, greater torque and faster engine turnover. All of these tend to produce more rapid starting. Capacity of receiver necessary to start an engine any desired number of times without recharging the receiver can be determined as follows: Receiver capacity in cubic feet equals the number of starts, multiplied by the consumption in cubic feet of air per start, multiplied by the atmospheric pressure in pounds per square inch, divided by 60.

Some arrangement should be included in the system design to charge the receiver from an external source. Present plant or shop air lines, bottled air or nitrogen, or service truck compressor, are suitable. An air admission valve should be installed directly on the receiver. Specify a "glad hand" air line connector on mobile equipment equipped with a compressor. This permits the system to be recharged by connecting it to the "glad hand" of similarly equipped unit.

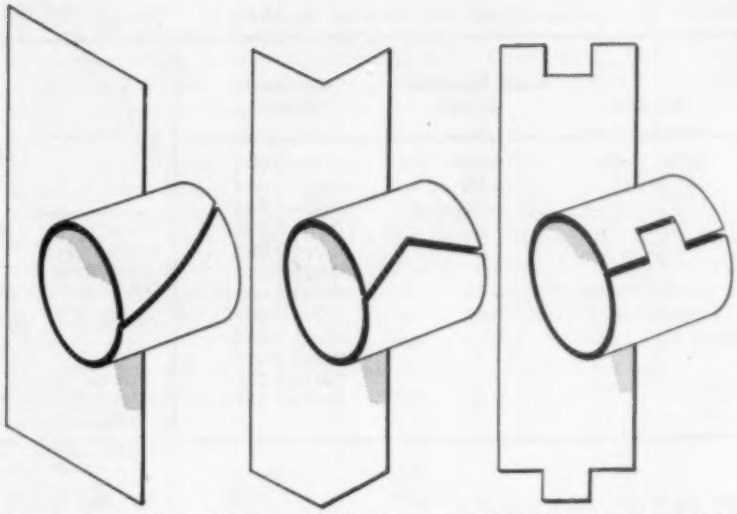
Basically, you can select the proper starting system to reduce your maintenance costs for either original installation or replacement of electric starting by four steps:

1. Determine the proper size air starting motor for your particular engine (Table I and Table II).
2. Check over-all dimensions listed in Table III to be sure that there is sufficient mounting clearance.
3. Determine air consumption per start (Table II).
4. Calculate the proper size receiver (Table IV). **End**

Table IV. Sizes, capacities, working pressures, materials of construction and weight of receivers.

Size, Inches	Capacity, cu. ft.	Capacity, Gallons	Max. Working Pressure, psi	Material	Bare Weight, pounds
14x60	4	30	125[1]	Aluminum	49
20x30	4.7	35	125[1]	Steel	66½
20x34	5.4	40	125[1]	Steel	74½
20x38	6	45	125[1]	Steel	82½
20x48	8	60	160	Steel	170
20x63	10.7	80	200	Steel	255

[1]Not coded—all others coded (approved by National Board of ASME)



One simple means of installing a plastic bearing is by the use of thin sections of tape. Typical examples of the wraparound bearings are shown above.

HOW TO WORK WITH PLASTICS FOR BEARING REPAIRS

By **GEORGE C. CARLYON**, Vice President—Manufacturing
Cadillac Plastic and Chemical Co.

IF BEARING performance is unacceptable under the special conditions of your job—for example, contaminating the product with lubricant or producing excessive noise levels—the problem may be solved by installing a plastic bearing.

Plastic bearings, however, are not recommended as a panacea for all problems of bearing wear or unsatisfactory performance. They are recommended whenever you encounter one of the following conditions (and loads and speeds are not excessive):

1. Lubrication is neglected or functionally impossible
2. Abrasives or corrosives are present
3. Equipment must start and stop without jerking — cannot tolerate stick-slip
4. Noise levels are unacceptably high
5. Electrical conductivity is present and undesirable
6. High loads and slow speeds tend to squeeze oil out of ordinary bearing surfaces
7. Intermittent operation causes metal-to-metal contact and wear during startup

The principal plastic materials currently used for bearings (other than the old standby phenolic- linen) are nylon, Teflon and acetal (Delrin).

These materials melt or distort at considerably lower temperatures than metals. As a result, they are generally used in thin sections, to minimize the possibility of failure by improving heat dissipation. Often they are used as liners in metal sleeves. Massive plastic bearings, machined from stock, also are used in many intermittent applications or where other special conditions exist.

Loads and Speeds: PV factors, that is the product of P (psi) and V (shaft velocity feet per minute) in Table II, are good guides to applications that can use plastic bearings,

Heavy nylon roller bearing guides were installed on this automated plating line to eliminate two problems; (1) lubrication, and (2) line disruption if plating rack shorts out.

Table I. Fit, clearances vary with material, thickness.

Material	Shaft Diameter (Inches)	Clearance (Inches)
Nylon, Teflon 70 to 150 F	0.25	0.002-0.003
	0.50	0.003-0.004
	0.75	0.004-0.005
	1.0	0.004-0.006
	1.5	0.006-0.008
	2.0	0.008-0.010
Delrin, Teflon 70 to 250 F	0.25	0.002-0.004
	0.50	0.004-0.008
	0.75	0.006-0.012
	1.0	0.008-0.015
	1.5	0.010-0.018
	2.0	0.012-0.021

Table II. PV factors are guide to use of plastic bearings.

	PV VALUE LIMITS[1] for continuous duty		
	NYLON	TEFLON	DELRIN
Dry	1800 to 3000	1,000 10,000* 30,000#	2000 to 3000
Water Lubrication	2000 to 3000		2000 to 3000
Oil, Initial	3000 to 5000		3000 to 5000
Oil, Wick	10,000 to 15,000		10,000 to 15,000

[1] These are maximum values of the product of load (psi) times shaft velocity (fpm), as determined under optimum laboratory conditions.
In general maintenance work a good rule of thumb would be to select a maximum value of 50 to 60 per cent of the above maximums to compensate for worm shafts, undue vibration, etc. For intermittent motion applications, higher limits are possible.
It is advisable to make preliminary tests on applications in order to determine the variables in an individual application.
* Filled compositions
# Teflon fiber—normally recommended for speeds up to 50 fpm.

PLASTIC BEARINGS

especially when the bearings are to run dry or with only initial lubrication. Even initial oil, such as is used when installing a bearing, increases the PV factor and if an existing high-output oiling system is retained or water lubrication substituted, this PV value may be even higher.

Fit and clearance: Recommended fit and clearances with plastics vary with the material and with diameter and thickness of the plastic bearing. In general, clearances should be larger than for metal bearings for three reasons: (1) plastics expand with heat more than metals and the added clearances prevent seizure; (2) plastics wear slower than metals and, after comparable running times, clearance in the plastic bearing will be substantially less than that in the metal one, and (3) one of the major reasons for snug fits with metals is to reduce chattering and noise. Plastics tend to absorb vibration and emit much less sound, eliminating that reason for close fits.

The recommended clearances shown in Table I are to be considered minimums for safe operation. In practice, clearances twice and occasionally three times as great have been successfully used.

Frictional heat: Important when using plastic bearings is the dissipation of heat due to friction. The problem is acute because of the low heat conductivity of plastic materials and because critical temperatures are much lower than for metals (although in the same range as common lubricating oils). At the same time excessive heat usually degrades a plastic bearing. For these reasons it is unwise to replace both shaft and bearing with plastic.

If the shaft can dissipate most of the heat, or if a flow of coolant (even water) is available, massive plastic bearing construction is acceptable. Such applications might include: (1) lightly loaded bearings running at low speeds; or (2) wheels rotating about axles where the load is applied to a continuously changing bearing area and the heat does not build up at any one point.

Since the rate of heat transmission through the plastic is a function of the temperature difference between hot and cold surfaces the cold-surface temperature must be kept as low as possible.

Means of accomplishing this are:

1. Providing an adequate mass of surrounding metal
2. Controlling ambient temperature (e.g. use of coolant, integral blowers, etc.)
3. Extending amount of surface through which heat passes from metal to ambient, by use of axial or radial fins around bearing assembly

Here are five simple techniques for installing a plastic bearing.

Bearings from tubing: In small-diameter sleeve bearings the switch from metal to plastics is easily accomplished by the use of tubing, such as thin wall nylon pressure tubing, Teflon electrical spaghetti or flexible tubing. The latter is available from warehouse distributors with inside diameters up to 1½ in.

Nylon pressure tubing is readily available in inside diameters up to ⅜ in. Teflon spaghetti is available in sizes up to ¼ in.

Here is how to do the work: Determine the diameter of the shaft and of the bore of the bushing. Select a tubing size with a diameter slightly greater than that of the shaft. Determine the added amount of clearance that will be required to slip-fit the tubing into the bore.

Ream out the bore enough to accept the tubing. In instances where bushing retainers were not used on the machine originally, it is advisable to leave a lip to retain the liner.

Then take the tubing and slice it diagonally, cutting up to an additional 1/64 in. off one edge to insure room for expansion.

Slip the liner into the bore. It will be held in place by its tendency to spring against the walls.

The slice provides room for expansion of the plastic material in case the bearing runs hot. There is no need to stake the nylon liner nor is there any need to do a precise job of reaming. If any burrs or rough spots are left, nylon's tendency to cold flow will enable the material to conform around them.

Wraparound bearings of tape: Another very successful practice, particularly with thin Teflon tape, is the wraparound technique. This involves little more than reaming out the existing bearing so there is sufficient space for the tape.

Again, installation is extremely simple. Wrap a piece of Teflon tape

around the shaft and slice the overlap with a razor blade or sharp knife. Then slice an additional 1/16 in. off one end to provide expansion room.

Nylon is much stiffer and even in thin sections cannot be wrapped around shafts much smaller than one inch in diameter. However, in split journals the nylon tape may be placed in position and the shaft allowed to rest on the plastic. Nylon tends to cold flow and often in less than 24 hours the strip has acquired the desired configuration.

Thick wall tubing: In some applications heavy tubular bar stock may be ideal, particularly for such applications as cams, conveyor wheels and material handling networks. In most instances standard warehouse shapes of nylon, acetal and Teflon are available in proper OD and ID so all that is needed is a cutoff tool in a lathe or the use of a hacksaw.

Shafts of plastic rod: In some instances, notably where loading is extremely low, replacement of the existing metal shaft with a plastic shaft may be easier than replacing the bearing. This is a good technique if the frictional point is constantly changing, and should minimize the danger of overheating.

Sliding bearings: All three plastics are recommended for many sliding bearing applications. Warehouse shapes readily lend themselves to maintenance work. Bars and strip stock of nylon, Teflon and acetal may be cemented to metal surfaces. The materials may be bolted to badly damaged rub rails on conveyors and processing systems. Both nylon and Teflon have good abrasion resistance and are virtually shatterproof. And because they are softer than metals, the work being processed will not be scarred or damaged.

All of these plastics are readily machined on conventional metal working machines and special sliding bearings such as dovetail units, may easily be made.

A word of warning: Plastics work best without lubrication in applications where loads and speeds are moderate. Where plenty of oil—or water, or liquid being processed—is available to carry off heat, heavier loads and higher speeds can be used. Oil is used much less as a lubricant—the plastics have coefficients of friction about one fifth that of metals—than as a heat dissipator.

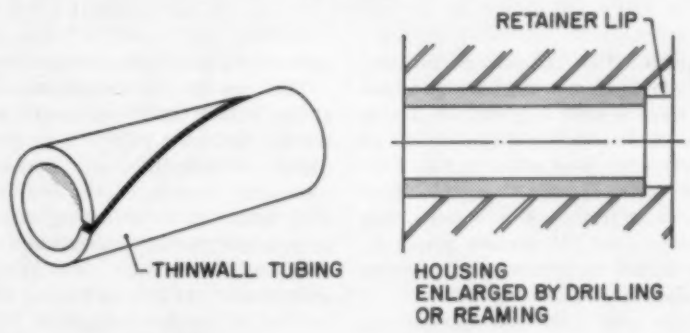
Of course, there are some differences between these three plastics. Some of the more important are:

Nylon: The most widely used plastic bearing material, has highest abrasion resistance and over-all strength of this group. Harmlessly embeds abrasive particles from the environment. Non-marring to polished surfaces. Has a high rate of water absorption.

Teflon: Lowest coefficient of friction known. Has no stick-slip—starting and sliding friction are identical.

Inert to virtually all known chemicals. High abrasion resistance—absorbs abrasive particles. But, with lowest heat distortion point of this group, is best confined to applications of moderate speeds or intermittent loads, unless special provision is made to carry off heat. Glass-reinforced Teflon tapes have higher strength than ordinary Teflon, accept much higher PV loads.

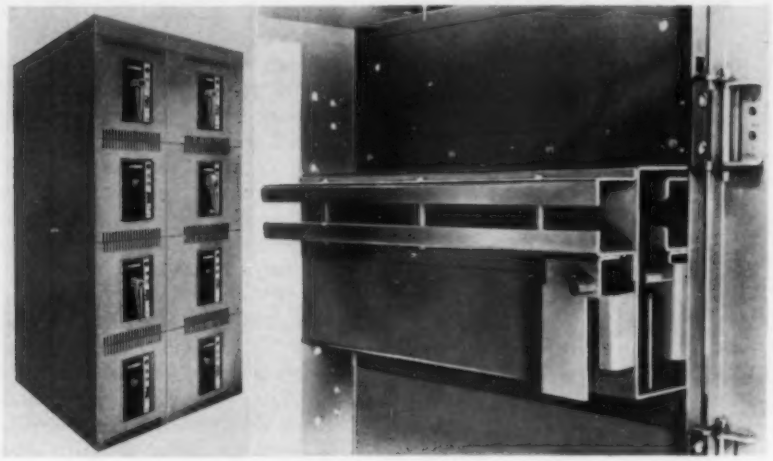
Acetal: Most rigid, has least cold flow of this group. Minimal water absorption—good for bearings in humid service. No stick-slip. Not as good abrasion resistance as nylon or Teflon. This material does not absorb particles. **End**



When installing thinwall tube bearing, tubing should be sliced diagonally. Cut additional 1/64th of an inch off one edge for expansion room.

Teflon strip was epoxy-cemented to ways of grinder to eliminate chattering or stick-slip. Low friction characteristics of the material reduce force required to actuate mechanism.

Fig. 1, left: Front view of a 400, 800 and 2000 amp breakers. Fig. 2, right: Rail used for adapting an FP100-2000 cell to receive an FP50-800 breaker.



LOW VOLTAGE POWER SWITCHGEAR BREAKS INTERRUPTING CAPACITY BARRIER

DESIGNED TO provide substantial dollar savings in industrial electrical system applications, a new line of low voltage power circuit breakers has been announced by Federal Pacific Electric Company, Newark, New Jersey. A completely new concept, the FP (future planned), line is said to be the result of years of research and development.

Now most industrial applications, the manufacturer points out, can have all the benefits of a fully-rated system at the price of a cascade system. After completion of research on circuit breaker applications, it was found that by increasing continuous current ratings from 225 to 400 amp, from 600 to 800 amp and from 1600 to 2000 amp, it would be possible to more closely meet user requirements.

This means you can economically meet the requirements of 50,000 amp interrupting capacity on light loads that previously required the use of high continuous current breakers. It also provides greater latitude in circuit breaker application than was previously practical. As an example, protection and control of equipment can be done with circuit breakers whose continuous current rating will more closely match equipment ratings.

This new line is divided into two groups called the FP-50 series and the FP-100 series. The FP-50 series consists of three frame sizes based on continuous current of 400, 800 and 2000 amp, all three having 50,000 amp asymmetrical interrupting capacity at 600 volts a-c. The FP-100 series consists of two frame sizes with continuous current ratings of 2000, 3000 and 4000 amp with an interrupting capacity of 100,000 amp asymmetrical.

Four 50,000 amp class breakers, rated up to 2000 amp continuous current, can be mounted in a single switchgear section, Fig. 1. Complete interchangeability of FP-50 breaker sizes is assured by a simple cell adapter, Fig. 2. This device extends the breaker guide rails into the cell, allowing the smaller frame size breakers to be inserted in exact position so that even the door remains unchanged.

Front door panels are louvered for effective ventilation and each door is hinged on one side and held by two flush fasteners on the other side. The sides and rear bus compartment are covered by removable flat steel plates. Bare aluminum bus bars, heavily silver plated for maximum conductivity, are braced against movement under the maximum fault current of the system.

The FP breaker can be moved from the "in" position, Fig. 3A, to the "test" position, Fig. 3B, to the "out" position, Fig. 3C, without opening the enclosure door. A handle is inserted into a drawout cam, and a single stroke moves the breaker into a different position. An indicator is clearly visible on the drawout cam for positive identification of the breaker position at all times. An interlock cover plate must be moved before the drawout handle can be placed into the cam. This movement of the cover plate automatically trips the breaker.

Each breaker can be completely drawn out of its cell for examination, maintenance or replacement, Fig. 4. Telescoping guide rails, rigidly attached to the breaker cell, provide a substantial support for the breaker to roll in and out. A positive stop at the end of the rails prevents further travel after the breaker has completely cleared the enclosure.

An integral breaker lifting device

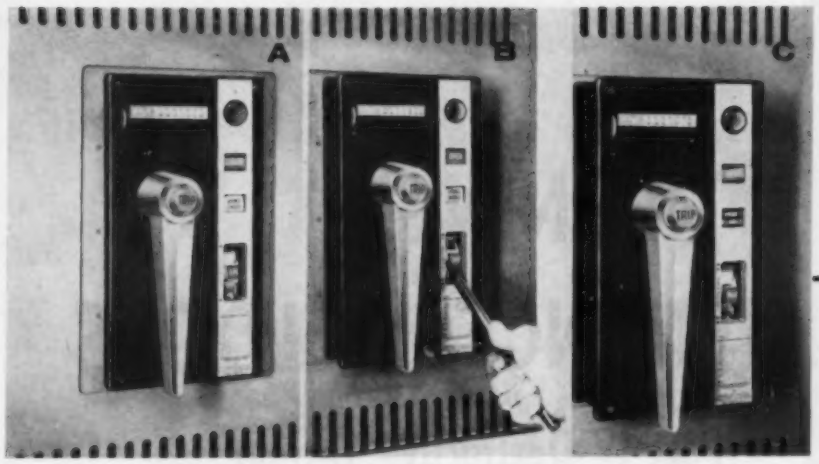


Fig. 3. Breaker can be moved from "in" position A, to "test" position B, to "out" position C, without opening enclosure, by using operating handle.

can be mounted within each 90-in.-high vertical section. The lifting hoist, driven by a fractional horsepower motor, is flush-mounted and normally not visible; when required for use, it is withdrawn on its telescoping mounting. A pushbutton station provides control so that installation and removal of breakers is a one-man job.

Operating mechanism of the FP-50 series breakers has an advanced design stored energy assembly which may be specified with any one of three different operating mechanisms. These are manually charged, electrically charged or a combination manually/electrically charged.

The stored energy mechanism consists of a driven cam which charges four closing springs with sufficient energy to close and latch the breaker, Fig. 5. The closing springs are retained in this fully-charged position until the spring energy is required for a closing operation. This energy is then released to the closing toggle which forces the circuit breaker to close.

Available options permit manually-charged energy breakers to accomplish most of the functions of electrically-operated breakers at lower cost. Specification of remote contact closing on a manually-charged breaker in a selective tripping system results in substantial dollar savings.

On electrically-operated breakers, a fractional horsepower, high speed, a-c/d-c motor provides spring charging energy in less than one second. The motor requires very low input which greatly reduces power requirements from a control power source. Electrically-charged breakers can be provided with a front-operated handle for optional manual charging.

The full range trip unit is completely field-adjustable to provide complete flexibility. Changes from preliminary system calculations, load concentration, load growth and other factors that alter system requirements can almost always be taken care of by a simple screwdriver adjustment to the tripping mechanism, Fig. 6. For some applications, it may be necessary to change trip coils, but this has been made a simple task that can be performed in the field quickly and efficiently using plant personnel.

The extended range series trip unit consists of a series trip coil and magnet assembly, and the TD timing device. The two components are joined by removable connecting rods to provide a simple field conversion when needed. Timing is obtained by a single element magnet on the general purpose timing device and by a dual element magnet on the selective timing device. Long time delay timing is obtained by the positive displacement of a silicone damping fluid in a piston. A simple, rugged mechanical escapement-type mechanism provides short time delay. **End**

Fig. 4. Breaker can be easily withdrawn on telescoping rails for examination, maintenance or replacement.

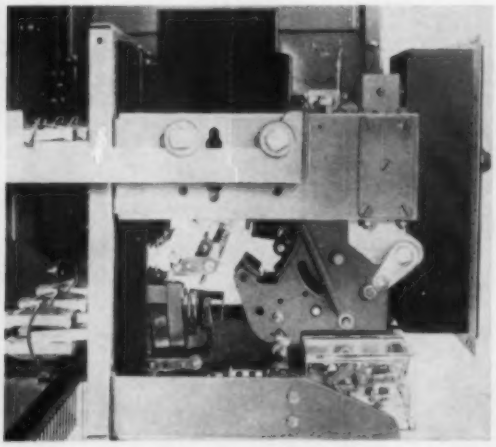


Fig. 5. Stored energy mechanism: driven cam charges closing springs which will close and latch breaker.

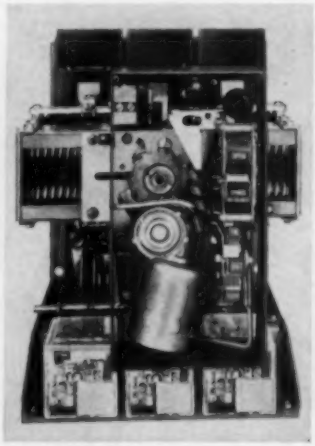
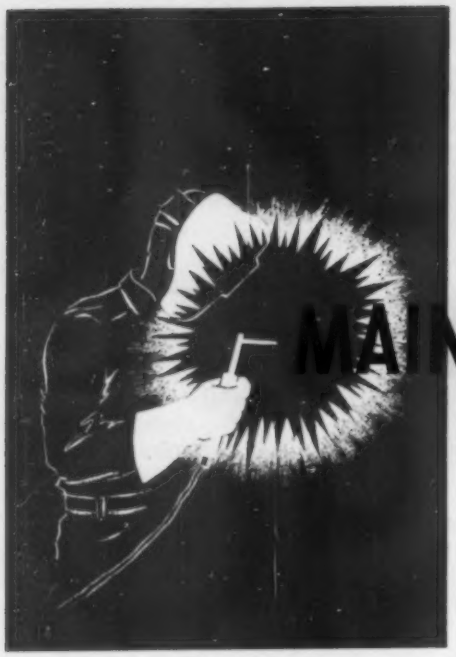


Fig. 6. Detailed view of the flexible selective tripping mechanism and timer. Trip coils are easily changed.



TRAINING MAINTENANCE WELDORS

Part IV-Destructive Testing of Welds

By **JOHN W. RANTALA** and **JACK ARZOOMANIAN**, Training Div., Maintenance Dept., Abbott Laboratories, North Chicago, Illinois

GOOD WELDS must have adequate tensile strength, shear strength and ductility. They must be internally sound and of proper shape and dimensions. No one test will reveal all of these characteristics and several tests are usually required to fully evaluate the welding operator's ability to make high quality welds.

Some of the various tests used to evaluate the quality of welds are:

1. Transverse Shear
2. Reduced Section Tensile
3. Root Bend
4. Face Bend
5. Fracture
6. Acid Etch

In the transverse shear test, the specimen is prepared as shown in Fig. 68 and machined to an exact width of 2½ in. The tensile strength of the metal used in the specimen is determined by computing the cross sectional area and multiplying by the strength of the material. In this example the cross sectional area is:

2½ in. x ⅜ in. = 2.5 x 0.375 = 0.9375 sq in.

In this specimen, the base metal has a tensile strength of 60,000 psi. The computed tensile strength of the test specimen is then 60,000 times 0.94 or 56,400 lb.

Double welded lap joints used in this test develop close to 100 per cent of the base metal strength. However, to allow for a slight loss in strength, multiply the computed tensile strength by ⅞. Required strength of the specimen is now ⅞ x 57,400 = 49,350.

Knowing the required strength of the specimen, it is placed in a tensile test machine, Fig. 69, and stretched until the weld breaks. If the actual strength of the specimen equals or exceeds the computed required strength, the welds are considered satisfactory. The actual shearing strength of the weld, in pounds per lineal inch, can be computed by dividing the maximum force by the sum of the length of the welds which ruptured.

In the reduced section tensile test, the specimen is machined to a reduced cross section dimension as shown in Fig. 70. Tensile strength is computed by again finding the cross sectional area and multiplying by the strength of the base metal. In this case the cross section is:

1 in. x ⅜ in. = 1 x 0.375 = 0.375 sq in.

The base metal is rated 60,000 psi

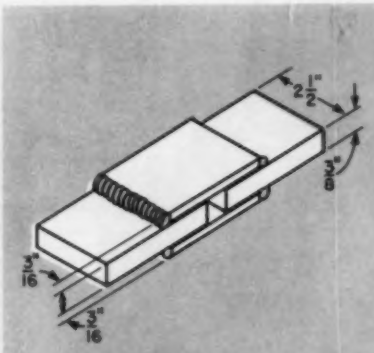


Fig. 68. Specimen prepared for transverse shear test to check weld.

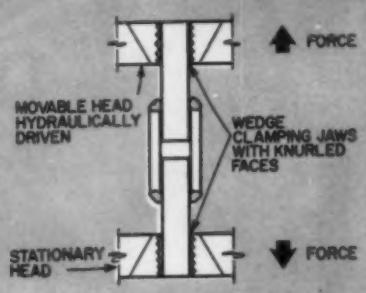


Fig. 69. Tensile machine stretches the weld specimen until it breaks.

so the computed tensile strength of the specimen is 0.375 x 60,000 = 22,500 lb.

A satisfactory butt joint must develop 100 per cent of the minimum tensile strength of the metal used in the specimen. The required tensile strength of the specimen is 22,500 lb. This specimen is also placed in the tensile strength machine for testing. If the weld pulls up to the required tensile strength, the weld is considered satisfactory regardless of whether it breaks "in" or "out" of the weld.

In the guided root bend test, the specimen is machined to an accurate uniform width as shown in Fig. 71. In this test, the specimen is placed in a bending jig with the root of the weld facing down. Hydraulic pressure is applied until there is 1/32 in. or less space between the female die and the test specimen, Fig. 72.

Convex surface of the specimen is examined for cracks and other open defects. Any specimen in which a deep cross sectional crack appears is considered to have failed. Cracks occurring on the corners of the specimen during testing are not considered if they are not over 1/8 in. deep.

This test will expose major internal defects such as slag inclusions, cold shuts, lack of fusion, incomplete penetration and cracks. The metal on the convex side of the specimen is stretched considerably so the base metal ductility is clearly indicated by the test. If cracks consistently appear in the heat affected zone adjacent to the weld, it may be an indication that preheating and post heating would be desirable.

Guided face bend tests are conducted in a manner identical to the guide root bend test except that the face of the weld is placed down in the bending jig. This stretching of the face of the weld reveals any overlap or lack of fusion at the toes of the weld. In this case the weld metal is stretched considerably so its ductility is indicated. The ductility of deposited weld metal is generally very good. Excessive heat with its accompanying boiling of the metal may destroy some of this ductility.

In the free face bend test the specimen is prepared as shown in Fig. 73. Gage lines are scratched lightly in the

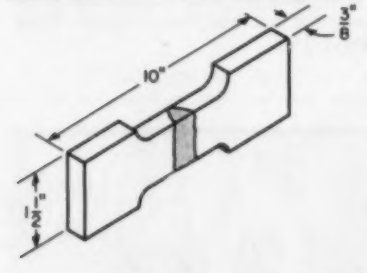


Fig. 70. In reduced section tensile test, cross section is cut down.

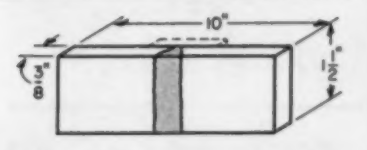


Fig. 71. Guided root bend test requires specimen be machined to size.

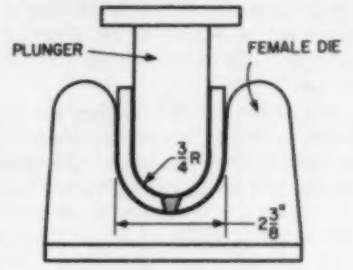


Fig. 72. Hydraulic pressure bends specimen until it conforms to die.

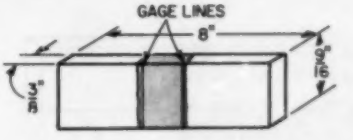


Fig. 73. Free face bend test requires light gage lines scratched on surface.

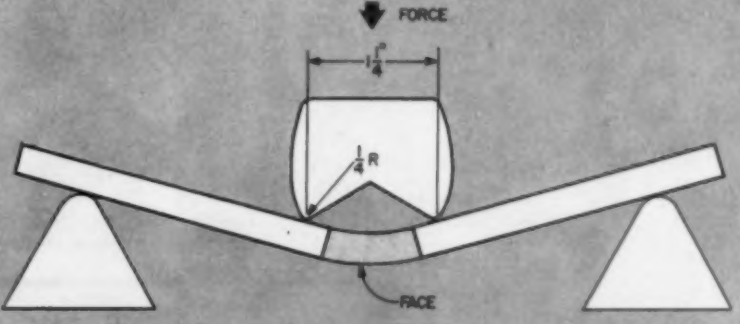


Fig. 74. Specimen is placed on two fulcrums and bent slightly. After initial bend, the sample is placed between two movable jaws for required final bend.

surface and measured with a flexible scale graduated in 1/100 of an inch. The specimen is then placed on two fulcrums and a slight bend is imparted, Fig. 74.

Free Face Bend Test

After the initial bend, the specimen is placed between movable jaws for a final bend. Compressive forces are applied until a sign of rupture or depression appears on the convex face of the specimen. If no crack appears, the specimen is bent double.

Elongation is determined by measuring the minimum distance between the gage lines to the nearest 0.01 in. and subtracting the initial gage length. Per cent elongation is obtained by dividing elongation by the initial gage length and multiplying by 100. Per cent elongation should be 20 per cent or better. Less than this would indicate a lack of ductility in the weld metal.

In the fracture or break test, force is applied as shown in Figs. 75, 76, or 77 to break the weld. Study of the cross section of the fracture will reveal common weld faults such as inadequate penetration into the root of the weld, inadequate depth of throat, porosity, slag inclusions or lack of fusion.

Inspection of the fracture should reveal a throat dimension equal to the thickness of the metal. The weld should be free of slag inclusions and porosity. Penetration into the root should be beyond the root intersection.

Acid etch testing is used to study the cross section of a weld that cannot be conveniently fractured. The weld is cut transversely, Fig. 78, and the sawed surface is filed and polished to a mirror finish.

Acid Etch Testing

An acid reagent is applied to the surface with a glass rod or by immersing the polished surface in boiling reagent under a fume hood. After etching, the weld is washed in clear hot water, immersed in ethyl alcohol, removed and dried in a warm air blast. The appearance may be preserved by coating with clear lacquer.

In this test the acid will dissolve slag, enlarge gas pockets, and show up cold shuts. The refined metal zone, weld metal zone and each bead will be distinctly visible.

Nitric acid is a good reagent to use for acid etching. Mix one part of concentrated nitric acid with three parts of water by volume. Always pour acid into water when diluting. Nitric acid will cause stains and severe burns if not handled properly. **End, Part IV.**

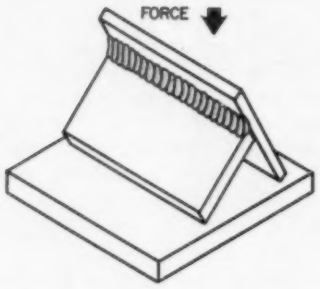


Fig. 75. Hammer or press supplies force for a fillet weld fracture test.

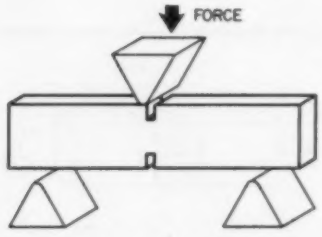


Fig. 77. In the nick break test, sample is nicked before pressure is applied.

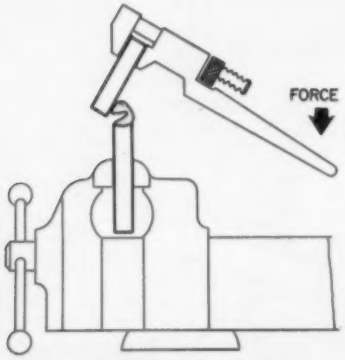


Fig. 76. Pipe wrench is used to supply the force to break this lap weld.

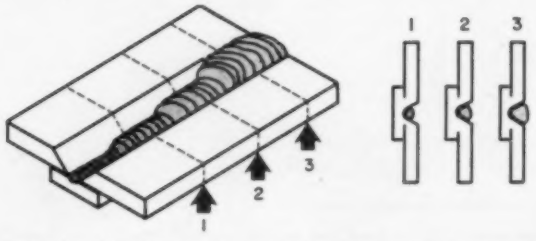


Fig. 78. Acid etch test is used to study cross section of multi-pass welds that cannot be conveniently fractured.

Watch for Part V in the next issue covering Qualification Tests for Welders.

LABELING TOOL SHOWS VERSATILITY

Hand-held "typewriter" embosses letters, numbers on colored plastic or metal tape to produce labels

APPLICATIONS of a handy labeling tool, that operates by embossing white letters on colored plastic tape, has shown its versatility in various industries.

Among these industries is the Los Angeles plant of North American Aviation—where at least three uses have been found for the made-on-the-spot, adhesive-backed labels. In one instance, the labels are used to identify switch boxes and electrical control boxes, as shown in Fig. 1. Cut and printed as needed, the labels are stripped of their protective backing, and the pressure-sensitive adhesive firmly cements the legend to the control box for ready identification by all plant personnel.

In production areas of the same plant, the labels are used to identify small parts, stocked at assembly stations along the production lines. As shown in Fig. 2, the parts containers at each assembly station are labeled with the stock numbers as well as the part name—assisting the assembler, in quickly identifying the parts she is using, and the stockroom attendant, in restocking the bins with a minimum of difficulty.

Inside the stockrooms, a slightly different application finds the labels being used without removing the covering over the adhesive back. Here, the labels are cut to identify boxes containing subassemblies and parts. However, rather than being fastened permanently to the boxes, they are simply slipped into metal slots secured to the front of each bin. These labels, then, are temporary, and can be readily changed as the subassemblies in the storage boxes are changed. This application of the labels, as cut on the Dymo-Mite Tapewriter, is shown in Fig. 3.

The labels cost about two cents each, and can be cut of various colors of tape, or embossed in aluminum tape. **End**

Fig. 3. Here, the labels are inserted in metal slots and can be changed as the storage parts are changed.

Fig. 2. Labels containing stock numbers and part name are placed on the parts containers at the assembly stations.

Fig. 1. North American Aviation is using colored plastic labels to identify switches and electrical control boxes.

Westinghouse
AB De-ion® breaker
selector
To use: Rotate the top disc until the desired information is obtained. Remember the colored area on the top disc should be matched to the colored section of the bottom disc to show physical characteristics. The white area shows electrical characteristics. For any given breaker, the electrical characteristics are directly opposite the physical characteristics on the selector.
Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania
Max. Amps
Interrupting Rating (Asym) 240 volts
a-c 480
a-c 600
DC
400
600
50,000
35,000
25,000
20,000
42,000
30,000
22,000
Max. Volts
Interrupting Rating (Sym) 240
a-c 480
a-c 600
DC
Depth
Width
Height
Replaces
Poles
4⅜
6¼
10¼
KL & JKL
2
3
4⅜
8¾
10¼
MA
E
FA
JA
KA
LA

GOOD DEAL ON A WHEEL

This selector wheel makes it easy for you to identify and specify the world's newest and most complete line of circuit breakers. Get one free from your Westinghouse representative or write to Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. You can be sure . . . if it's Westinghouse

MARK 75* . . . interrupts up to 75,000 amps at 240 volts a-c, and costs only a fraction of conventional high interrupting capacity breakers. Excellent for network systems.

TRI-PAC* . . . smallest, lowest cost protective device you can apply where 100,000 amps can be poured into faults—e.g., network or large transformer-fed systems.

SAF-T-VUE* . . . lets you see whether the contacts are open or closed. Fills the needs of every industrial plant where safety codes require visible contacts. All frame sizes.

AMBIENT COMPENSATED . . . ends nuisance tripping, and eliminates need for derating where elevated or changing temperatures are encountered. All frame sizes.

MAGNETIC ONLY . . . provides short circuit protection only. Primarily used on motor circuits where overload protection is provided by other means. All frames but E.

THERMAL MAGNETIC . . . provides instantaneous opening on short circuits. On sustained overload, the higher the current the shorter the opening time. All frames.

*Trademarks

J-30329

Reinforced Concrete Drainage Conduit Drilled To Receive Roof Drains

ROOF AND SURFACE DRAINAGE was a major consideration on the new continuous hot strip mill being constructed at River Rouge for the Great Lakes Steel Corp., division of National Steel. Job specifications called for 50 holes to be cut into a drainage conduit to permit connection of downspouts.

Holes were to be eight inches in diameter, with a counterbore 10 in. in diameter to permit mounting of the downspout flange flush with the outside surface of the pipe. Made of reinforced concrete, the drainage conduit was approximately five inches thick.

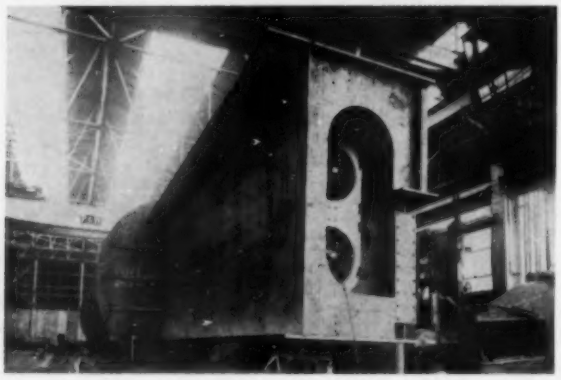
To complicate the problem, the holes had to be drilled at a 45-deg angle from the horizontal and perpendicular to the surface of the pipe.

A Truco portable diamond drilling machine, one eight-inch and one ten-inch masonry diamond bit, all products of the Masonry Drilling Div., Wheel Trueing Tool Co., were used. The drill was powered by a Thor air motor.

After construction crews had completed installation of the drainage conduit, locations of the downspout holes were established. A template was used to locate two anchors that were used to anchor the base of the Truco machine to the wall of the conduit in the drilling position.

Setup time per hole averaged approximately 15 minutes, with a half-hour allowed for actual drilling of the hole and countersink. Location of the downspout holes and placement of the anchors was done while the previous hole was being drilled.

Outsize Box Girder Fabricated On Rollers To Ease Welding Problems



TWO 14-FT DIAMETER rings of welded steel plate, fitted with triangular gusset braces and mounted on powered rollers, were used to turn a 102-ft-long 96-ton girder into various positions for downhand submerged arc welding on web-to-flange seams.

The box girder is the main element of a structural support system for two 100-ton cranes at Alan Wood Steel Company's new blooming mill in Conshohocken, Pa.

Flange plates for the girder are 77 in. wide, with 34-ft end sections, butt welded to a 22-ft center section. Web plates are ¾ in. thick, nine feet, 10 in. deep. Diaphragm plates are ¾ in. thick, spaced every six feet.

Longitudinal fillets were laid down at speeds up to 26 ipm, with Lincoln Electric's mechanized welders.

Twin exhaust fans were mounted in an end diaphragm plate to clear the interior air for weldors' comfort.

Glass-Fusing Furnace Features Air Curtain Doors, Humidity Control

THREE HUNDRED TEN feet long, a new gas-fired continuous straight-through furnace for fusing glass linings to water heaters is in operation at the A. O. Smith Corporation plant at Kankakee, Illinois.

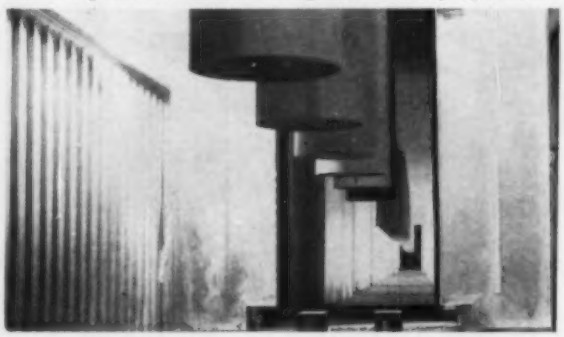
The only furnace of its type located outside the plant, it has a 130-ft firing section capable of providing heat at 25,000,000 Btu per hour.

Conventional entrance and exit doors to the furnace have been eliminated through the use of air-curtains. Despite the extreme heat in enameling furnaces, moisture conditions generally pose problems during the glass-fusing process. The new furnace controls the dew-point in the firing section through the feeding of chilled dry air that maintains the exact atmosphere necessary for perfect fusion of the glass coating to the steel.

Other unique devices carry off flue gases that could interfere with the fusing process, and electric eyes have been installed along the length of the furnace that sound an alarm and provide instantaneous shut-off if necessary.

The furnace, supplied and installed by the Ferro Corporation of Cleveland, operates between 1,630 to 1,800 F.

Carried continuously on an overhead conveyor system, the water heaters move out through the air curtain "door" into the plant for manufacturing and assembly operations.



how to control temperatures with gas unit heaters

Free from Reznor: "Commercial and Industrial Uses of Direct Gas-Fired Unit Heaters", fourth in Reznor's new series of Heating Handbooks, contains valuable information on how to choose the right heater to achieve and maintain desired temperatures in a wide variety of applications.

Reznor manufactures four heater series, each of which has a different control arrangement regulating the length of heating cycle and fluctuation from room temperature setting. Your choice depends upon the degree of comfort desired for the specific job.

Choose from: the Reznor Standard and Deluxe series, with controls designed for use in warehouses, storerooms and manufacturing plants; the Reznor Unitemp series, with sensitive low-voltage controls, for offices and restaurants; and the Reznor Flexitemp series, with low-voltage controls and automatically operated two-speed fan, for banks, libraries, and finer offices. Each series features eleven sizes. You may specify either propeller or centrifugal fan.

To guide you in your specifications, send for your copy of the latest Reznor Heating Handbook, published by the world's largest manufacturer of gas unit heaters. Just mail the coupon below, or contact your nearby Reznor distributor. He's listed in the Yellow Pages under "Heaters-Unit".

REZNOR HEATERS

REZNOR MANUFACTURING COMPANY
Dept. PE-7, Mercer, Pennsylvania

Send me a copy of "Commercial and Industrial Uses of Direct Gas-Fired Unit Heaters."

name_____ title_____

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Circle 561 on postcard, page 33

Otis

IS ELEVATOR MAINTENANCE COMPLEX?

YES! It is an organization task requiring an unusual combination of skills. Plus a wide knowledge of parts, assemblies, functions, replacement procedures, testing and adjusting. Plus the availability of original replacement parts. Plus immediate local service in emergencies.

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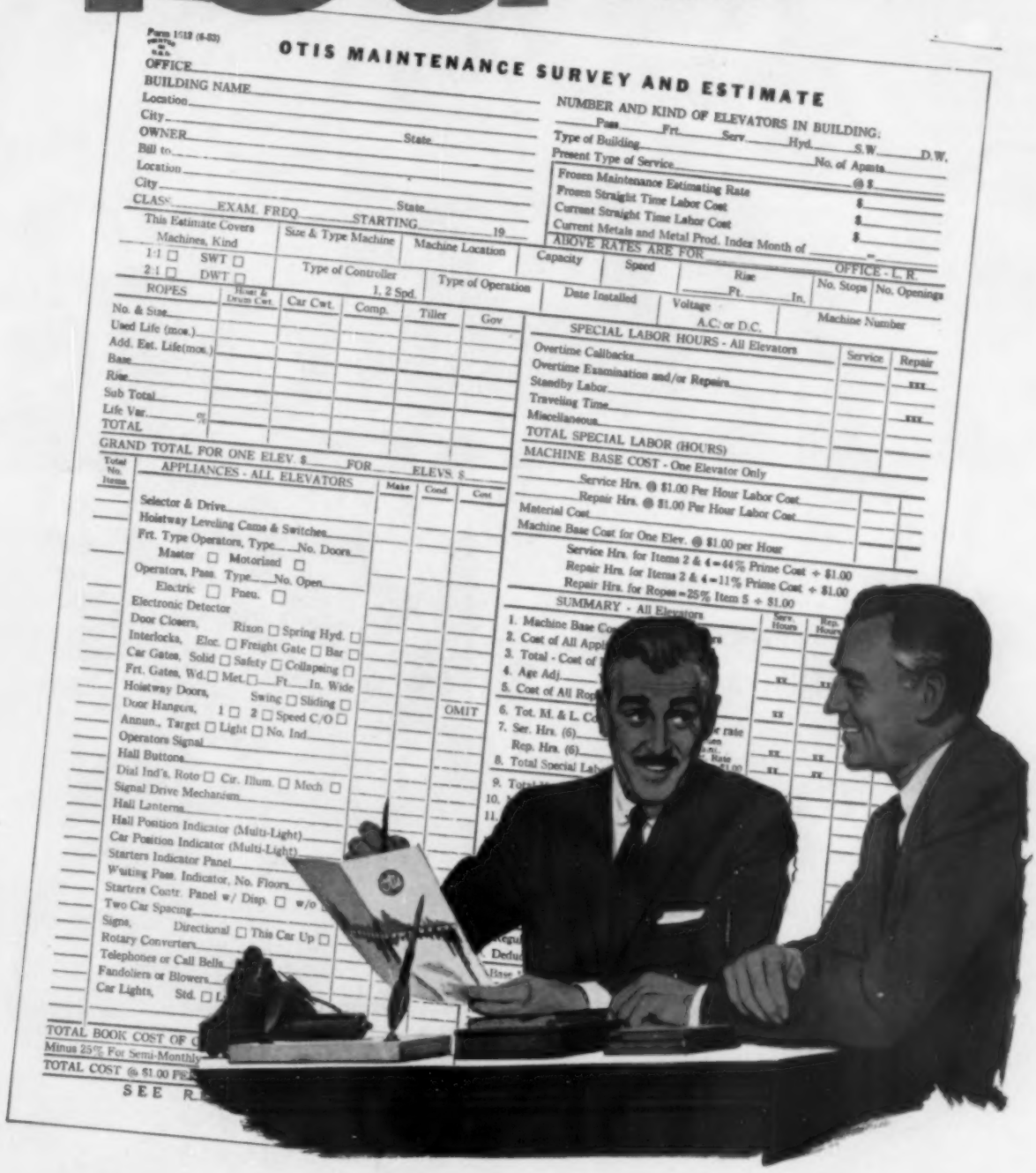


HOW DO YOUR COSTS compare with professional elevator maintenance? OTIS can figure your costs accurately. We can tell you why it will pay you to have OTIS keep your freight elevators running like new. We can reduce your shutdown costs. We can eliminate unexpected repair bills. We can hold your costs to one fixed monthly charge. Why not ask your local OTIS man for a FREE Maintenance Survey and Estimate. Then let the figures decide!

Circle 562 on postcard, page 33

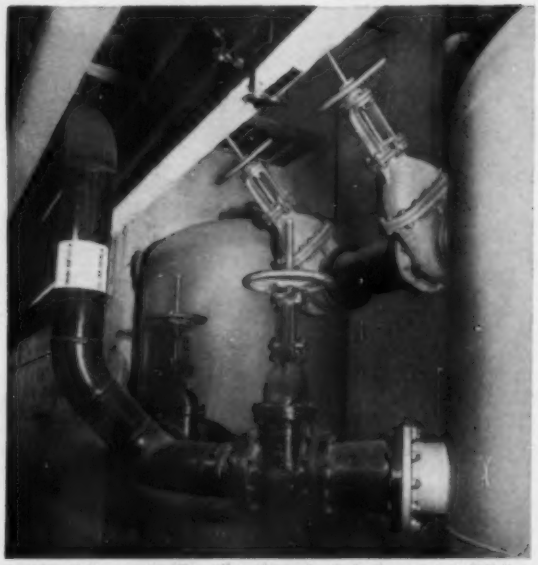
Over 600,000 sq. ft. plant with capacity of two million tires a year. Designed by engineering staff of Gates Rubber Co.
General Contractor: RUST ENGINEERING CO., Birmingham, Ala.

GATES specified the valves that stand hard work, longer ... JENKINS VALVES

Because high pressure steam, compressed air and water play a big part in making auto and truck tires, valves work unusually hard in this new Gates Rubber plant near Nashville, Tenn.

To be sure of valves that would stand such punishing service, Gates Rubber called for Jenkins Valves. And, with 2500 of them controlling processing and service lines, Gates can look forward to substantial savings in valve maintenance and replacement costs.

Your job for valves may not be so tough, but the extra-quality of Jenkins Valves is well worth specifying . . . especially since you pay no more for it. It's true . . . Jenkins Valves not only *cost less* in the long run.— they *cost no more* to buy. Jenkins Bros., 100 Park Ave., New York 17.



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VALVES
JENKINS SINCE 1864 Jenkins Bros

Circle 563 on postcard, page 33

Circle 564 on postcard, page 33 ➔

NEW . . . An Industry First
and only NATIONAL ELECTRIC Has It

CO OR-CO SHERARDUCT*

rigid steel conduit

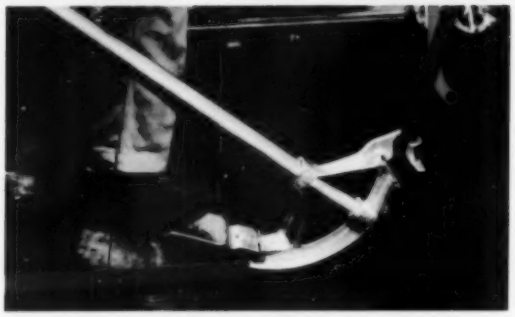
*Galvanized Conduit at its BEST . . . and MVC-1 Poly-Vinyl protected.

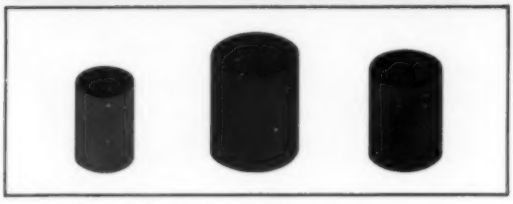
NATIONAL ELECTRIC
The best way to put power in place

Now you can have Sherarduct, the industry's standard in Galvanized Conduit, factory-coated in five colors that make location and identification of electrical runs simple and easy.

New Color-Coded Sherarduct makes it possible for you to separate conduit runs from water, steam, air and other service lines. Within your electrical distribution systems, new Color-Coded Sherarduct lets you color the runs to indicate type of service and voltage, makes your system more flexible by cutting the time needed for relocation and modernization.

NEW from NATIONAL ELECTRIC — Color-Coded Sherarduct . . .
Galvanized Conduit With These EXTRA Features





DOUBLE PROTECTION. Color-Coded Sherarduct gives you extra protection against rust and corrosion. More than just a "dip", Color-Coded Sherarduct is made with National Electric's exclusive Sherardizing process in which pure zinc is alloyed with the steel and threaded ends of the conduit.

After the zinc alloying, Sherarduct is immersed in a bath of MVC-1 Poly-Vinyl to which special, extra quality, color pigments have been added. MVC-1 Poly-Vinyl is recognized as an excellent protector against corrosion.

Outside, MVC-1 Poly-Vinyl envelops the zinc-coated surface, and the added color makes identification permanent.

Inside, MVC-1 provides a lasting, smooth surface for the easiest fishing possible.

ELIMINATES PAINTING. With Color-Coded Sherarduct, you eliminate the cost of on-the-job painting. Your finish is neater than ordinary surface coating and can be matched to the job. You can specify five basic colors or order special colors to match the color scheme of the installation.

NO FLAKING OR PEELING. Color is on for life because it's part of the MVC-1 Poly-Vinyl finish. It's baked on, and the toughest on-site bending won't flake or peel the hard uniform surface of Color-Coded Sherarduct.

FITTINGS TOO! Because color and surface are factory-applied, you take advantage of the best. They're made under the most exacting manufacturing conditions possible. Even elbows and couplings get the same special attention.

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IMMEDIATE DELIVERY THROUGH YOUR NATIONAL ELECTRIC DISTRIBUTOR!

Color-Coded Sherarduct is available now in all standard sizes in Galvanized steel.

Each length comes to you with a coupling attached, and a plastic colored thread protector on the open end to indicate sizes.

Order your requirements now!

DIMENSIONS AND WEIGHTS

CONDUIT

Nominal or Trade Size of Conduit (Inches)	Inside Diameter (Inches)	Outside Diameter (Inches)	Wall Thickness (Inches)	Length Without Coupling (Feet and Inches)	Minimum Weight of Ten Unit Lengths With Couplings Attached (Pounds)
½	0.622	0.840	0.109	9-11¼	79.0
¾	0.824	1.050	0.113	9-11¼	105.0
1	1.049	1.315	0.133	9-11	153.0
1¼	1.380	1.660	0.140	9-11	201.0
1½	1.610	1.900	0.145	9-11	249.0
2	2.067	2.375	0.154	9-11	334.0
2½	2.469	2.875	0.203	9-10½	527.0
3	3.068	3.500	0.216	9-10½	690.0
3½	3.548	4.000	0.226	9-10¼	831.0
4	4.026	4.500	0.237	9-10¼	982.0
5	5.047	5.563	0.258	9-10	1344.0
6	6.065	6.625	0.280	9-10	1770.0

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Hydraulic presses should work smoothly, with no jerk or erratic action. But sludge and varnish in an Eastern plant's presses caused uneven operation, with increasing "rejects."

A Sinclair lubrication engineer recommended Sinclair's new DURO hydraulic oils with oxidation, rust and foam inhibitors. Result: outstanding performance, with "rejects" cut to minimum.

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Circle 565 on postcard, page 33

SUPER-QUIET WESTINGHOUSE TRANSFORMERS SLASH INSTALLATION COSTS BY $2163 AT CHICAGO EXPOSITION CENTER

Chicago's new Exposition Center, shown in scale model, provides a 70,000-foot main exhibition hall and complete facilities for holding big conventions, trade shows and fairs. Installation of 65 super-quiet Westinghouse dry-type transformers assures an available total power supply of 16,000 kva and reduces objectionable noise.

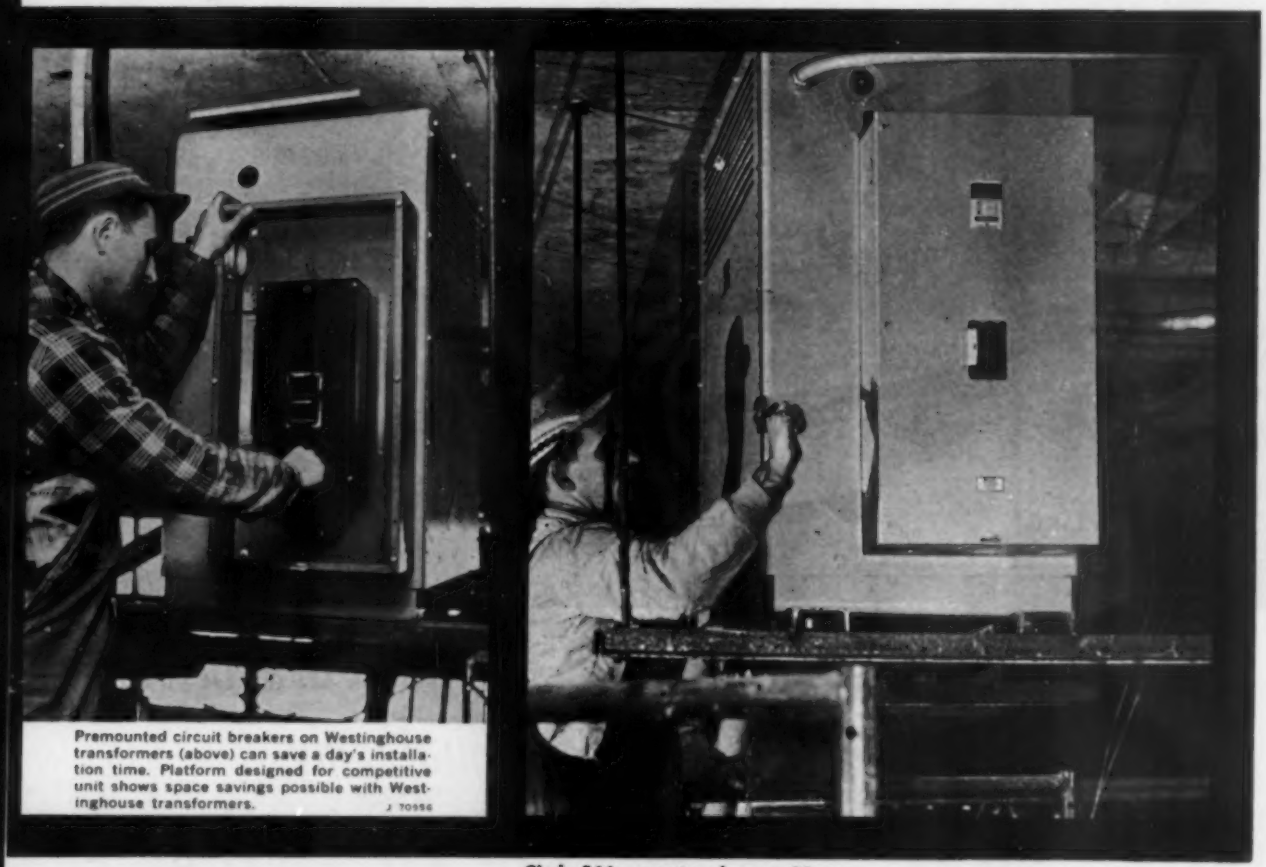
At Chicago's new Metropolitan Fair and Exposition Center in Burnham Park, extremely low sound levels were set for the transformers, ranging from 34 decibels on 9-kva units to 42 decibels on 300-kva units. Extensive tests both at the factory and on location show the sound of Westinghouse DS-3 and DT-3 dry-type transformers substantially below these levels.

The compact Westinghouse dry-type transformers were installed on trapeze platforms suspended from the ceiling at considerable savings. Trapeze locations were spotted in advance and ceiling rods preset before pouring concrete. The lightweight Westinghouse transformers were then quickly raised into place as complete units by a two-man crew without extensive rigging equipment. Cost estimates show that, because the transformers came with premounted circuit breakers, installation time on each unit was cut by eight hours. Total installation savings: about $2163.

When the entire 70,000-foot main exhibition level is in use — or when any portion of it is used — the power supply is completely adequate. Some eighteen 225-kva Westinghouse transformers serve this main hall; others are used in lecture, meeting and conference rooms, dining areas, the garage, and storage rooms.

Westinghouse dry-type transformers can meet your requirements . . . and save you money. For more information, contact your nearby Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

You can be sure . . . if it's **Westinghouse**



Premounted circuit breakers on Westinghouse transformers (above) can save a day's installation time. Platform designed for competitive unit shows space savings possible with Westinghouse transformers. J-70556

Circle 566 on postcard, page 33

this

bearing gets 0.003 cubic inches of lubricant
every 15 minutes . . . automatically.
installation cost: $5.75 per bearing.

the frequency concept

in automatic lubrication

KEY TO:

lower maintenance costs / longer parts life

The frequent application of small, measured amounts of refinery-pure lubricant directly to bearings . . . that's the reason why automatic lubrication gives such remarkable savings in maintenance costs and such dramatic increases in parts life. The timeclock becomes the overseer of this precise operation. It triggers the charge of lubricant through main supply lines to the injectors that meter the exact amount to the individual bearings.

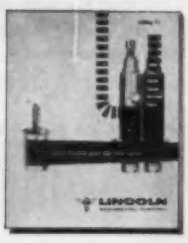
The highly polished bearing surface is always protected by a fresh supply of lubricant. It's little wonder that these precision parts stand up under constant high-speed service with a fraction of the wear shown by hand-lubricated bearings. The expensive result of improper lubrication comes with parts replacement. It isn't just the cost of the bearing . . . it's the labor time to replace it and the lost production!

Whether you build or buy machinery, you protect your investment with a dependable Lincoln automatic lubrication system.

LINCOLN ST LOUIS

LINCOLN
ENGINEERING COMPANY

ST. LOUIS 20, MO. • DIVISION OF THE McNEIL MACHINE & ENGINEERING CO.



SEND COUPON FOR NEW CATALOG

LINCOLN ENGINEERING CO.
Dept. PE-7
4010 Goodfellow Blvd., St. Louis 20, Mo.

☐ Please send me your new Catalog 82 on Lincoln centralized lubrication systems.

Name_____

Firm_____

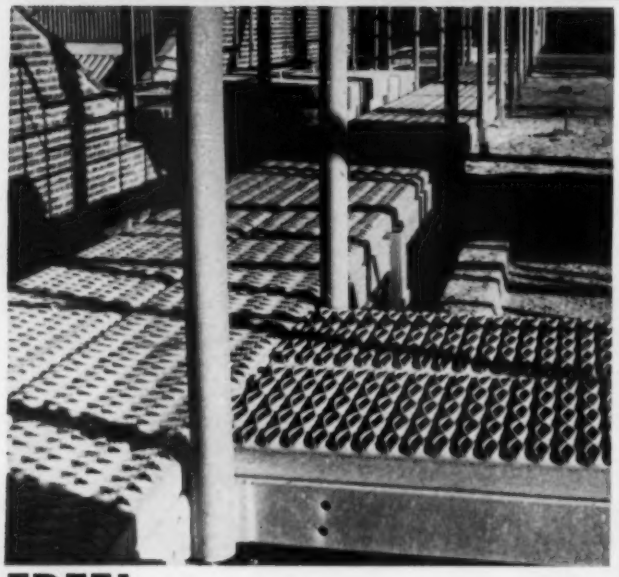
Address_____

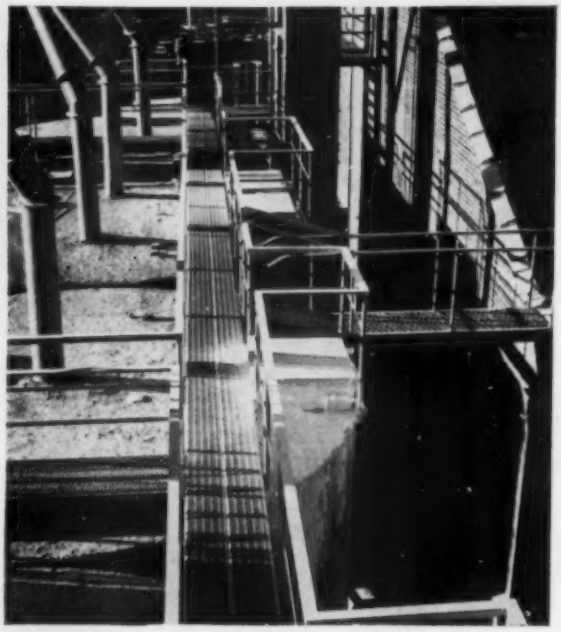
City_____ Zone____ State_____ 16109

Circle 567 on postcard, page 33

CATWALKS... anyone?

See how Owens-Illinois solved their catwalk problems at their **LIBBEY GLASS PLANT** at Toledo with GLOBE'S *Safety* **GRIP-STRUT** PATENTED





FREE! New Globe Safety Grating Catalog, completely illustrated with full data, load charts and specifications on this superior open steel floor safety grating of one piece construction in Steel, Aluminum and Stainless Steel. For architects, consulting engineers, plant superintendents, contractors, builders—for every safety purpose . . . fire proof, slip proof, maximum strength with minimum weight—cool in summer, warm in winter, self-cleaning. A grating for any purpose, any load, any budget. Write for your free copy today.

Representatives in all principal cities... consult the yellow pages in your phone book under "Grating" for the one nearest you.

PRODUCTS DIVISION • THE GLOBE COMPANY

4016 SOUTH PRINCETON AVENUE • CHICAGO 9, ILLINOIS

119

Circle 568 on postcard, page 33

PPG Fiber Glass Pipe Insulation is quickly installed, provides top thermal insulation at Fontainbleau Towers addition in Miami Beach. 100,000 ft of this insulation was used, as well as PPG Duct Liner and Duct Insulation.

"We chose PPG Fiber Glass Insulation Materials because they are easier to handle than any other insulation products"

. . . says Mr. Joseph Crabtree, President, Crabtree Insulation Company, Miami, Florida

Crabtree Insulation Company had the contract to install all pipe and ductwork insulation in the new 405-room addition to Fontainbleau Towers, Miami Beach. Choice of materials was given to the company.

Mr. Crabtree asked his superintendent what materials he felt should be used, and was advised that the men preferred PPG Fiber Glass Insulation Products because they were easier to handle.

As a result, Crabtree Insulation Company used 100,000 ft of PPG Pipe Insulation, 25,000 ft of PPG Neoprene-coated Duct Liner, and 25,000 ft of PPG Duct Insulation in the new Fontainbleau Towers addition.

Mr. Crabtree reports the insulation job went faster and with fewer problems than if other materials had been used. On the basis of this job and other jobs where he had used PPG materials, he would recommend PPG with no hesitation to other contractors.

WANT TOP RESULTS? TRY PPG!

PPG has a wide range of fiber glass thermal and acoustical insulation products that speed installation, provide excellent insulating properties, give long service life with little or no maintenance. If you haven't tried them, get full information by contacting your nearest PPG Fiber Glass Sales Office, or by writing *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

FIBER PPG GLASS PITTSBURGH PLATE GLASS COMPANY

Sales Offices: Atlanta, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Kansas City, Louisville, Los Angeles, Miami, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis and Seattle.

Circle 569 on postcard, page 33

District Headquarters, The Austin Company, Cleveland.

When Engineer-Builders Build for Themselves . . .

IT'S JOHNSON PNEUMATIC CONTROL

These two buildings were built, for their own use, by men whose organization has designed, engineered, and built thousands of industrial plants and commercial buildings.

As it has done for so many of its clients, The Austin Company has provided its own personnel with buildings that are attractive as well as highly functional. Both buildings are air conditioned, of course. And both are equipped with specially planned Johnson Pneumatic Control Systems to assure a consistently comfortable and productive working climate.

Wherever quality and performance are the key considerations, as they so obviously were here, you will usually find Johnson Control . . . a fact well worth remembering when you build or air condition. Johnson Service Company, Milwaukee 1, Wis. 110 Direct Branch Offices.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

General Offices, The Austin Company, Cleveland.

Circle 570 on postcard, page 33

PACKAGED

for Easy Handling
Protection and Inventory Control

Complete product identification and data on label attached to carton.

Write for Folder PF-2 for complete data on quantities and weights of the items as packaged in various sizes of cartons. Address Dept. 24A-FPLE.

HENRY VOGT MACHINE CO.
P. O. Box 1918, Louisville 1, Ky.

SALES OFFICES: Camden, N. J., Charleston, W. Va., Chicago, Cleveland, Dallas, Los Angeles, New York, St. Louis.

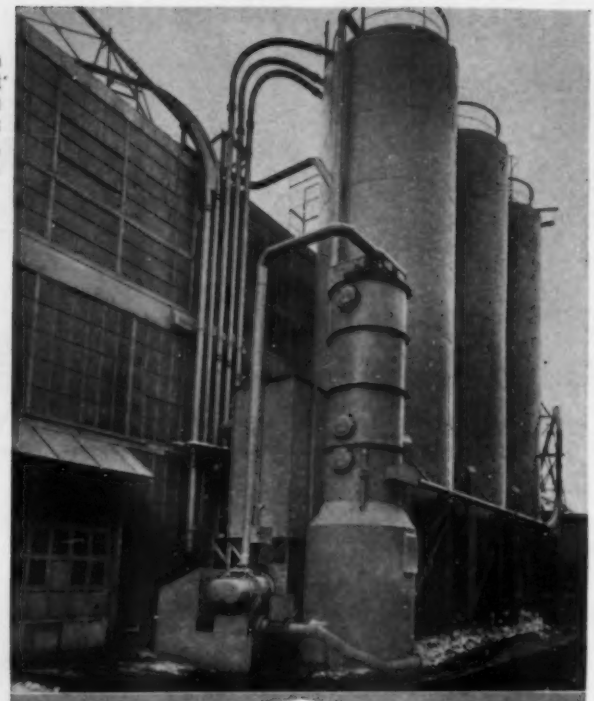
Vogt

For Direct Long Distance to Louisville dial: 502 ME 4-9411

Forged Steel FITTINGS, FLANGES and UNIONS

Circle 571 on postcard, page 33

One man and this Airstream Conveyor pushed costs down at Wehr Steel Co. Compact system moves bulk foundry materials from railroad cars to storage, later transfers them to process.



PUSH COSTS DOWN....

move up to modern handling

look how these

foundries cut costs with Dracco Airstream Conveyors

Major automotive foundry saves $32,000 a year in labor costs! Airstream Conveyor unloads core binders 400% faster than manual methods, moves them at 20 tph to eight storage bins without intermixing.

Wehr Steel Co., Milwaukee, realized multiple cost savings with its Dracco Airstream Conveyor. Bulk buying cut bentonite costs over $12,000 a year, reduced sand and other material costs $3-$5 a ton. Bulk handling slashed labor costs 50%.

Large aluminum foundry by-passes costly handling by air conveying sand from railroad cars to 100-ton silo at 10 tph. Labor required: one man. Cost of bags: eliminated. And there is no dust, waste, safety hazards or expensive maintenance.

Kelsey-Hayes Co., Detroit, air conveys seacoal and bentonite to mulling stations. One man with a push button-controlled Airstream system pushes costs down here, assures 100% material usage with no dust or waste.

Modernized bulk handling with Dracco Airstream Conveyors introduces improved productivity at lower cost. Savings result from bulk buying, less labor, faster handling, cleanliness, safety and simplified maintenance. Why not include a Dracco Airstream Conveyor in your cost reduction program?

For expert assistance when you move up to modern handling, contact: Dracco Division of Fuller Co., Harvard Avenue and East 116th Street, Cleveland 5, Ohio.

Write today for further information. Ask for 32-page Bul. 530, "Dracco Airstream Conveyors".

DRACCO *airstream* conveyors
dust control equipment

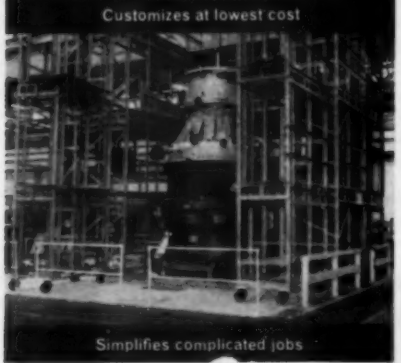
FULLER COMPANY GENERAL CONTRACTORS

Circle 572 on postcard, page 33

HOW TO TIGHTEN UP ON FRAMING COSTS

Versatile as your ideas

Customizes at lowest cost



Simplifies complicated jobs

Acme Steel's AIM Brand Slotted Angle frames anything faster, easier, stronger . . . at less cost

Bring on any framing job—platforms, ladders, steps, work tables, benches, stands, conveyors, storage racks . . . even complete staging areas. Acme Steel Slotted Angle will tackle them all . . . complete them all with amazing speed, ease and material savings.

Simplicity is the secret. This rugged, galvanized steel do-all material is simply sheared to size with an AIM Brand Cutter and bolted together. The cutter and a wrench are the only tools needed. No drilling, sawing or welding. And Acme Steel's exclusive pattern of precision slots and holes aligns perfectly with opposite members. There's no figuring and finagling to fit pieces. Your men can master assembly in minutes. Obviously, manpower savings are tremendous.

AIM Brand's superior bolting pattern also gives you virtually unlimited design freedom, plus unparalleled structural rigidity.

All factors considered—initial cost, assembly savings, design versatility and 100% reusability potential—you'll come out way ahead with Acme Steel Slotted Angle.

Your local AIM Brand distributor can meet your supply needs from his stock, and can assist in many other ways. He's listed in the Yellow Pages under "Racks" or "Shelving."

ACME STEEL IDEA LEADER IN FRAMING

ACME STEEL COMPANY, Fabricated Materials Division, Dept. PED-71, 135th St. & Perry Ave., Chicago 27.

Please send me new 24 page book, "Creative Framing at Lowest Cost", illustrating plant-wide uses of Slotted Angle in standard length and new ready-to-assemble kits.

*Name*_____

*Title*_____

*Firm*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

Circle 573 on postcard, page 33

PETRO® BALL VALVE

FEATURES DOUBLE UNIONS AT NO EXTRA COST!

After years of thorough research and testing, Clayton Mark has introduced its new PETRO BALL VALVE—with outstanding engineering features and built-in performance, which makes it singularly attractive to almost every piping and valve application. The essence of simplicity, the valve body can be removed without disturbing any other part of the piping . . . in just 13 seconds! The PETRO BALL VALVE is designed with features that make it definitely superior to other valves: ① easy quarter-turn improved handle, ② completely contained seals, ③ floating ball gives tighter seal, ④ interchangeable dual seats, ⑤ largest port opening, ⑥ rust-proof one-piece forging and ⑦ cadmium-plated nuts. And remember—*each and every PETRO BALL VALVE is air-tested under 100 pounds pressure to assure perfect operation.*

Distributorships available on a selective basis

1608

CLAYTON MARK & COMPANY

1900 DEMPSTER STREET • EVANSTON, ILLINOIS • U.S.A.

PUMPS · WATER WELL SUPPLIES · CONDUIT · UNIONS · TUBING

Circle 574 on postcard, page 33

What Really Happens Inside the Bucket

Exploding a widespread misconception of the operation of inverted bucket steam traps

In describing the operation of the inverted bucket trap many well meaning people—and some not so well meaning; i.e., competitors—refer to the need for a "bucket full of steam" to close the trap, and a "bucket full of condensate" to open the trap. The implications of these requirements are many. Sometimes they are contradictory. Often they are misleading. Observations of a trap with a glass body and a glass bucket plus trap design considerations tell the true story.

* * *

In a well designed inverted bucket trap (Armstrong, naturally) the bucket will float and close the valve when it is *no more than two-thirds full of steam.* For example, the bucket in an Armstrong No. 812 trap is $3^{15}/_{16}$" deep. It will float with only 2" of steam.

Good design also dictates that the maximum test opening pressure of a trap should be well in excess of the maximum working pressure for which the trap is furnished. For example a No. 812 trap for 100 psi with the bucket filled with cold water should open at a test pressure of at least 165 psi. Therefore, the bucket does not have to fill completely with condensate to open at 100 psi. The entrance of 1.20" of condensate will cause the bucket to sink. .8" of steam remains at the top of the bucket at the time it is heavy enough to open the valve at 100 psig and with no back pressure.

Thus the opening and closing of a 100 psi trap with $3^{15}/_{16}$" deep bucket is controlled by a change in the water level of only 1.20".

In actual practice the 100 psi trap may be draining a steam main in which daytime pressure is only 30 psig. Instead of requiring a 1.20" rise in bucket water level to open the trap against this pressure, the bucket will be heavy enough to open the valve as soon as the water level in the bucket has risen about $^{3}/_{16}$".

Obviously, it does not "take a bucket full of steam" to close the inverted bucket trap, or a "bucket full of condensate" to open the trap.

What's the Significance?

As illustrated above the opening of an Armstrong Trap requires the accumulation in the trap of less than one-third of a bucket full of condensate. This assures good operating characteristics for the vast majority of services by discharging small accumulations of condensate as soon as they reach the trap. It also assures frequent opening pressure drops to break up air and condensate films on heat transfer surfaces and thereby maintain high heat transfer rates in the unit being drained.

Additionally, the fact that no more than two-thirds of a bucket of steam is required to float the bucket means that there will always be a generous water seal at the bottom of the bucket. In the case of the No. 812 trap described above, it will be 1.8" deep. This insures that no steam can leak from the bottom of the bucket. More importantly, the bucket can float to close the valve even when the bucket is not completely submerged in condensate.

A Proven Principle Engineered Up to the Minute

While the inverted bucket concept for steam traps is half a century old, today's Armstrong inverted bucket traps incorporate design considerations unknown 50 years ago. The inverted bucket of the Armstrong trap, for example, is not just an upside down bucket. It is a carefully sized, weighted and vented component of a steam trap mechanism that experience proves will do its job right. Throughout, Armstrong design has kept pace with technological advancements, modified when necessary to meet changing requirements.

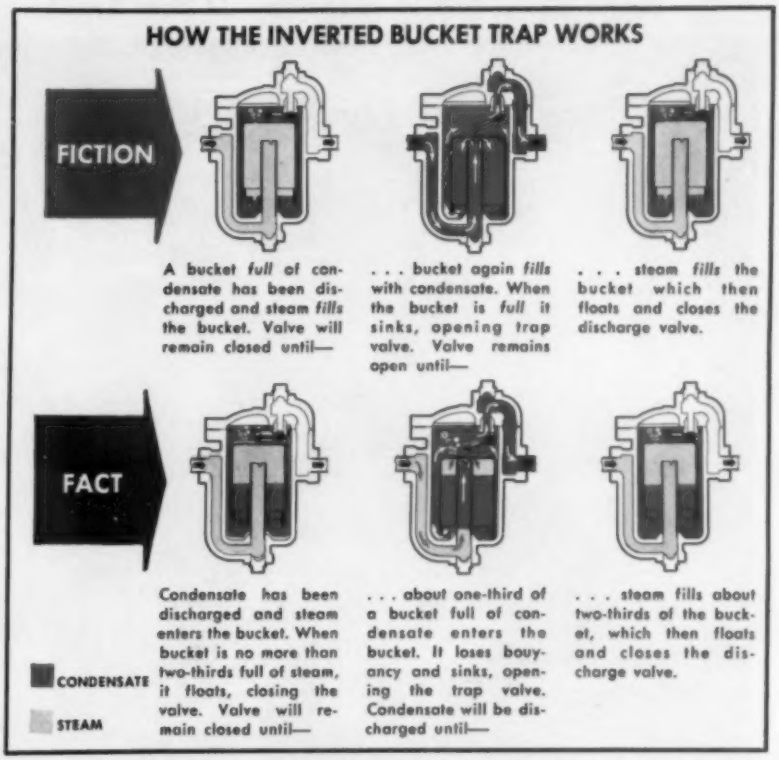
We do not claim that Armstrong Traps will do every single job better than any other trap. But we do believe it will do more jobs better and more consistently than any other trap. More important, though, for most services, Armstrong Inverted Bucket Steam Traps enable you to get more efficient steam utilization with minimum problems.

We're so sure of what Armstrong Traps can do that we unconditionally guarantee that they will satisfy you. You are the sole judge, too, so there's practically no risk.

* * *

The 48 page Armstrong Steam Trap Book describes other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write: **Armstrong Machine Works, 9125 Maple Street, Three Rivers, Michigan.**

ARMSTRONG STEAM TRAPS

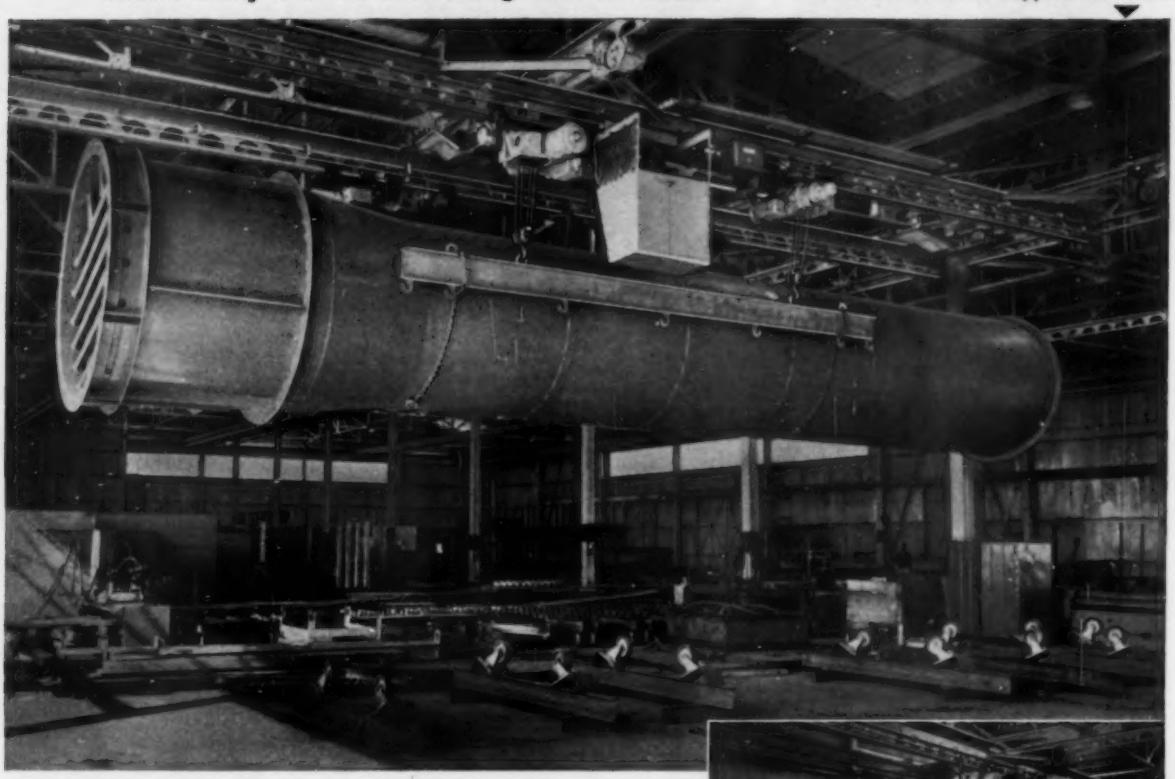

HOW THE INVERTED BUCKET TRAP WORKS
FICTION
A bucket full of condensate has been discharged and steam fills the bucket. Valve will remain closed until—
. . . bucket again fills with condensate. When the bucket is full it sinks, opening trap valve. Valve remains open until—
. . . steam fills the bucket which then floats and closes the discharge valve.
FACT
Condensate has been discharged and steam enters the bucket. When bucket is no more than two-thirds full of steam, it floats, closing the valve. Valve will remain closed until—
. . . about one-third of a bucket full of condensate enters the bucket. It loses bouyancy and sinks, opening the trap valve. Condensate will be discharged until—
. . . steam fills about two-thirds of the bucket, which then floats and closes the discharge valve.
CONDENSATE
STEAM

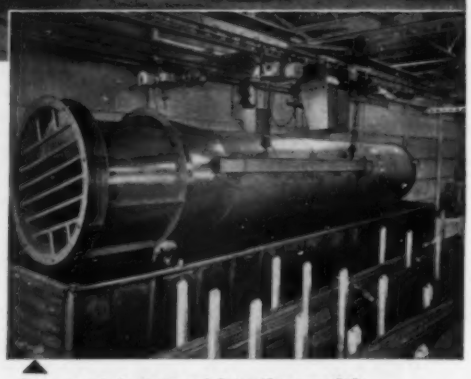
Circle 575 on postcard, page 33

HUGE STACK HANDLED
with Light Tramrail Cranes

Two Standard Cleveland Tramrail Cranes Make Easy Job of Handling 11 Ton Stack

Two cab-operated Cleveland Tramrail cranes working together lift 11 ton stack. Each crane has two 5000 lb. electric hoists handling a spreader beam. Chains between the beams support the stack.





The stack is lowered into the gondola car gently and accurately.

Cleveland Tramrail cranes are versatile in operation and offer handling advantages not normally possible with other forms of conveyance. They can be used to overcome difficult handling situations which occasionally arise and otherwise would be very difficult and costly.

The handling of a heavy stack made by Central Texas Iron Works Co., Waco, Texas, with two of their Cleveland Tramrail cranes, offers a good illustration. The cranes operate on the same three-track runway in one bay of the shop, are cab-operated and rated for five ton loads. Their principal function is handling large steel plates, bundles of reinforcing rod and various structural items.

The handling of the stack, nearly 50 feet long, weighing 11 tons, was not contemplated when the Tramrail crane installation was planned. Yet by working the two cranes together, the stack was easily lifted from the area where it was fabricated, moved a long distance in the shop high over various equipment on the floor and lowered into a gondola car at the end of the building. Despite the slight overload, the cranes moved the stack very smoothly.

For maximum materials handling flexibility, as well as efficiency, it will pay you to look into the possibilities of Cleveland Tramrail cranes.

"WE ARE SOLD ON CLEVELAND TRAMRAIL"

Central Texas Iron Works writes:

"We are sold on Cleveland Tramrail because you build good equipment and because you are represented in Texas by a very fine dealer who is interested in helping us solve our material handling problems most economically rather than just trying to make another sale."

(May we add that all Cleveland Tramrail distributors have the same business philosophy).

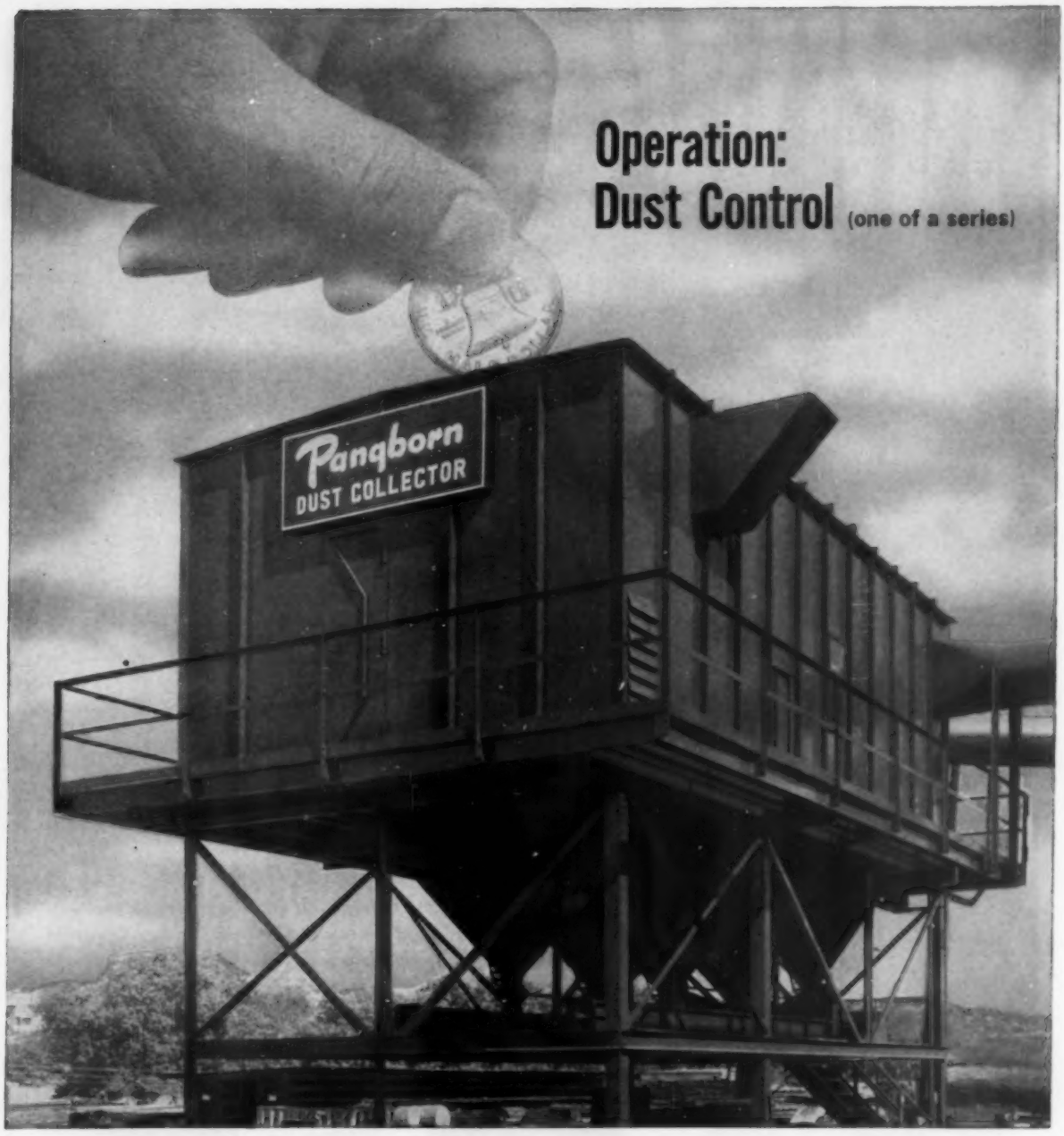
Write for free booklet No. 2008

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 7562 E. 290 ST. • WICKLIFFE, OHIO

Circle 576 on postcard, page 33



EVER SEE A BANK LIKE THIS?

Salvaged dust can mean money in the bank. And Pangborn Dust Control equipment works quickly and efficiently to reclaim valuable dust for you.

Yet salvage opportunities are only a part of the savings offered you by Pangborn Dust Control equipment. It also eliminates health hazards in your plant and makes for better housekeeping; it removes abrasive or corrosive dusts that can endanger machinery; and it increases the efficiency of your employees and improves community relations.

Pangborn has the right Dust Control equipment for all your needs: Dry Collectors in Cloth Bag, Tube, Screen, Self-Cleaning, Unit Types and Wet Collectors in all sizes. For all the facts write:

Pangborn Corporation, 3200 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada, Ltd., 47 Shaft Rd., Toronto, (Rexdale), Canada; — Manufacturers of Dust Control, Blast Cleaning and Vibratory Finishing Equipment . . . ROTOBLAST® Steel Shot and Grit.®

Pangborn
OF HAGERSTOWN

Circle 577 on postcard, page 33

NEW

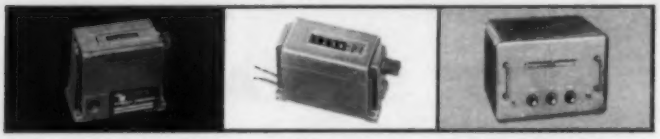
simplified photoelectric counting equipment

new matched design offers

- SIMPLIFIED OPERATION
- LASTING DEPENDABILITY
- MINIMUM MAINTENANCE

Now General Controls brings you the successor to present-day counting equipment actuators. The new General Controls photoelectric light source and receiver feature integral power supplies—built-in internal intensity adjustment for long life and minimum maintenance. Engineered to withstand high vibration without failure. Available in five different combinations of light sources and receivers—housed in remote or matching dustproof, splash-proof aluminum cases.

There's a General Controls PIC Electric Counter to fit every purpose



CE-800 Super Wizard Electric Counter

- 200 million count life
- Built-in rectification for reliability and quiet AC operation
- Available in completely dustproof, tamperproof gasket-sealed housing

CE-600 Industrial Electric Counter

- 50 million count life
- Built-in rectification for reliability and quiet AC operation
- Basemount, panelmount knob reset, panelmount key reset and electric reset models

CE-901 Predetermining Counter

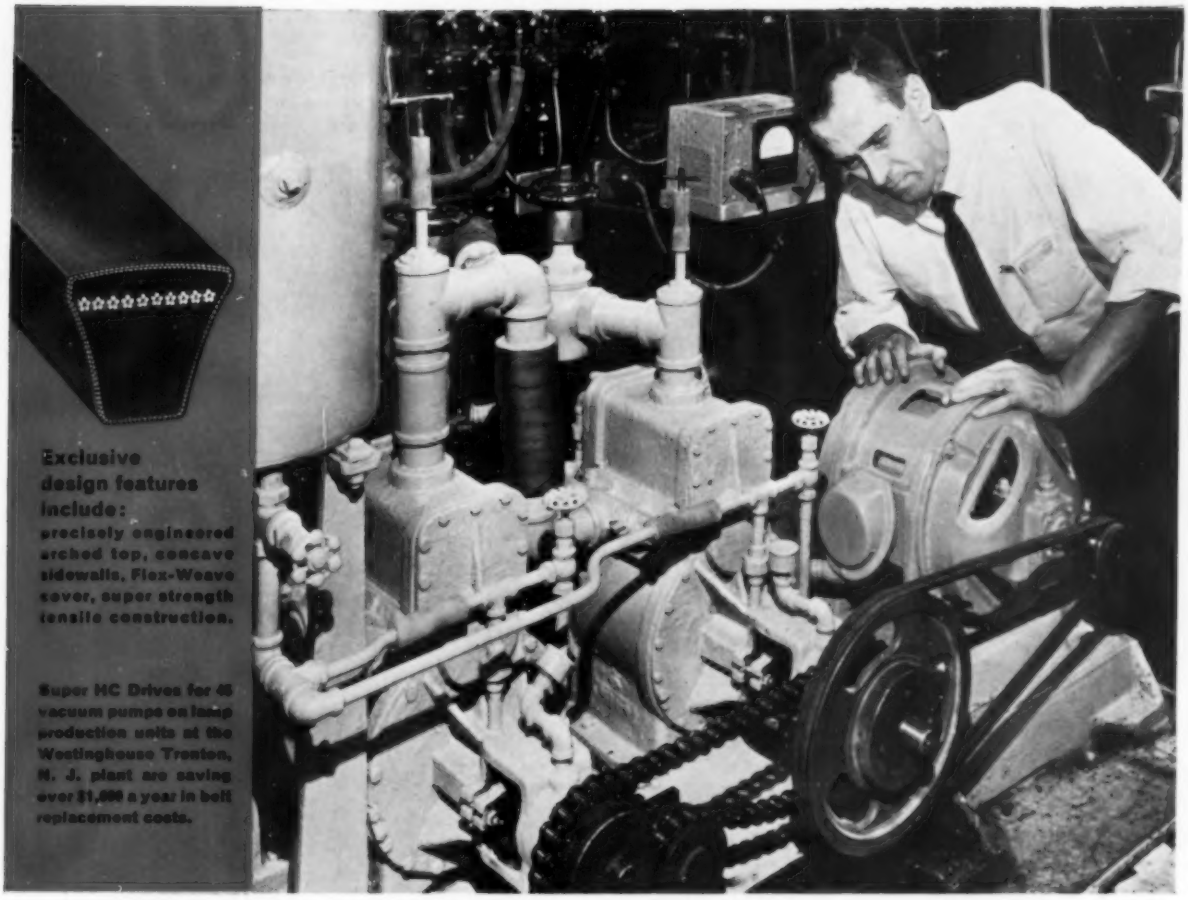
- 1000 counts per minute
- Employs any sensing device operating within actuator specifications
- Steel case protects components from dust, moisture — Desk and rackmount models.

AUTOMATION CONTROLS DIVISION

GENERAL CONTROLS

8080 McCormick Boulevard • Skokie, Illinois

Circle 578 on postcard, page 33



Exclusive design features include: precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

Super HC Drives for 45 vacuum pumps on lamp production units at the Westinghouse Trenton, N. J. plant are saving over $1,000 a year in belt replacement costs.

Westinghouse converts drives on 45 machines to new Gates Super HC High Capacity V-Belts

When drive space is limited, a driver sheave too small in diameter is sometimes used—though not recommended. Constant flexing over a small sheave is severe punishment for V-belts. Because of this, conventional V-belts lasted 4 months or less on the vacuum pumps on lamp production units at the Westinghouse Lamp Division plant in Trenton, N.J.

Now, with space-saving Gates Super HC High Capacity V-Belt Drives on all 45 machines, all belts are still running strong after more than 1½ years . . . a saving of over $1,000 in belt replacement costs plus even greater savings through reduced down-time.

The Gates Super High Capacity V-Belt is a new concept in V-belt design.

It is industry's first and most advanced high capacity V-belt. Because of exclusive design features, Gates Super High Capacity V-Belts transmit up to 3 times more horsepower than conventional V-belts in the same space. Or the same power can be handled with fewer belts and smaller sheaves in less space.

As a result, Gates Super HC Drives save up to 50% in drive space . . . cut your drive costs as much as 20% . . . reduce drive weight 20% and more . . . and make possible further savings in material costs.

For complete design information about the Super HC Drive and for expert drive design assistance, contact your nearby Gates Distributor.

Building the future on 50 years of progress

The Gates Rubber Company, Denver, Colorado BP4H

Gates Super HC V-Belt Drives

Circle 579 on postcard, page 33

Mobilplex EP grease has good pumpability over wide ranges of temperature and shear rates. Here, Mobilplex EP is pumped through a 24-foot coil of ⅜" tubing frozen in ice at 15 F . . . remains pumpable, permits continuous delivery even at critical pumping rate.

Mobilplex EP resists both water wash and runout caused by heat. In this demonstration, an immersion heater is used to boil water in a conventional mesh vegetable strainer coated with Mobilplex EP. Grease maintains a water-tight film even under these adverse conditions.

Mobilplex EP gives extra protection against wear under heavy and shock loads. Here, two split "bearings" consisting of V-shaped bushings are clamped under equal pressure on a polished steel shaft. The front bearing is lubricated with Mobilplex EP; the rear bearing with a high quality non-EP grease. When bearings are reciprocated in opposite directions, the shaft turns with the rear bearing, indicating frictional resistance is greatest at this point.

EVALUATION SUMMARY
MOBILPLEX EP (M) and 5 Leading Competitive EP Greases (A,B,C,D,E)

PROPERTY EVALUATED	RATING			
	Excellent	*Good*	*Fair*	*Poor*
Heat Resistance	M	A	C,D,E	B
Service Performance	M	A,C,E	B,D	
Extreme Pressure	M ,A,C	B,D,E		
Anti-Wear	M ,A	B,C	D,E	
Rust Protection		M ,B,C, D,E		A
Water Resistance		M ,B,C	A,D,E	
Handling Properties		M ,A,B C,D,E		
Controlled Bleeding		M ,A,C	B,D,E	
Non-staining		M	A,B, D,E	C

This chart summarizes results of an extensive evaluation program at Mobil Research. For complete details ask your Mobil representative.

The Multi-Service Grease with unique Calcium EP Complex. Never before in a single lubricant such a wide range of use . . . such a margin of superiority . . . such a potential for maintenance savings!*

Versatility unparalleled...

Mobilplex ep

A product of Mobil research . . . Mobilplex EP . . . a Multi-Service extreme-pressure grease far superior in quality and range of applications to any multi-purpose grease available.

Mobilplex EP, with a unique Calcium EP Complex, provides maximum protection against wear, rust, washout and heat. Because of its greater versatility, Mobilplex EP goes further than competitive extreme-pressure greases in simplifying your lubricant application, storage and purchasing practices. This new-type lubricant has given industrial machines greater protection while replacing as many as seven other greases. Mobilplex EP has all of the advantages usually associated with EP greases—as well as excellent storage, structural and oxidation stability.

Examination of the Socony Mobil evaluation summary at left shows that in comparison with five competitive extreme-pressure lubricants Mobilplex EP is the only grease excellent or good in every grease quality tested. No wonder aluminum and steel mills, metalworking shops, cement plants, and the chemical and rubber industries are reporting dramatic success with Mobilplex EP.

For full details contact your local Mobil representative, or write Mobil Oil Company, 150 East 42nd Street, New York 17, New York.

*Multi-Service means excellent for all types of anti-friction and plain bearings under various operating conditions up to temperatures in the range of 300 F. and for all types of dispensing equipment.

For a descriptive brochure and specific recommendations, cut out and mail on your letterhead.

Mobil Oil Company, Room 2057B

Gentlemen: Re: Mobilplex EP Grease Ad. Please have technical representative call to discuss:

- ☐ Performance results.
- ☐ A specific grease lubrication problem involving water____ caustic____ acid____ heat____.
- ☐ Reducing the number of greases in my plant.

MOBILPLEX EP
THE MULTI-SERVICE GREASE
OFFERING UNEQUALLED POTENTIAL FOR MAINTENANCE SAVINGS FOR LUBRICANT SIMPLIFICATION

Mobil

Proved Petroleum Products . . . Available with a Mobil Program of Correct Lubrication

Circle 580 on postcard, page 33

Together, fellow fasteners, we can build an empire!

There are 125 different kinds of us, all strong and true and ready to carry our share of the load! We're powder-actuated and we mean business. We have threaded studs and drive pins (super-nails!). There's tall ones, short ones, in-between ones; there's fat ones and there's lean ones. Every last one of us can ram home into steel or concrete with ease. One every *fifteen seconds*. We can attach things down on, up against and suspended from. With our eyepins the Hanging Gardens of Babylon would still be hanging! We're the kingpins. We're the elite. We're austempered, to a man. A tougher group you'll never find. So give us a chance, that's all. Give us a chance and by the George Washington Bridge we'll build you an empire!

Our dealers are assistant empire-builders, but they're listed in The Yellow Pages under TOOLS. Talk to them about *your* empire. (Among other things, they'll tell you why we have red tips.)

Ramset®

294-G Winchester Ave., New Haven 4, Conn. WINCHESTER-WESTERN DIVISION **Olin**

Circle 581 on postcard, page 33

Cuts 1-inch bar stock in 23 seconds flat!

New Skil Model 701 . . . world's only portable electric, metal-cutting hacksaw!

This all-new, Skil Model 701 Recipro Saw is the only portable power saw made specifically for fastest cutting of *any* metal—from hardest alloys (including stainless) to mild steels and non-ferrous metals. It's the one saw you need for every metal cutting job that requires a portable tool for cut-off or pattern work.

Model 701 has 2 speeds—1000 and 1400 strokes per minute—for extremely fast cutting of different gauges and densities of metals, with longest blade life. Standard equipment includes steel carrying case and 4 assorted blades.

New improved version of Skil's *all-purpose* Model 700 Recipro Saw also available. Has 2600 and 3500 spm speeds for wood, composition, plastic and routine metal cutting jobs.

For more information, call your Skil distributor. Look under "Tools-Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 120G, 5033 Elston Avenue, Chicago 30, Ill.

Skil Model 701 Recipro Saw makes toughest metal cuts fast

EXAMPLE—Model 701 cuts ¼" x 1½" stainless steel angle in 65 seconds!

EXAMPLE—Model 701 cuts 2" cast iron pipe in 105 seconds!

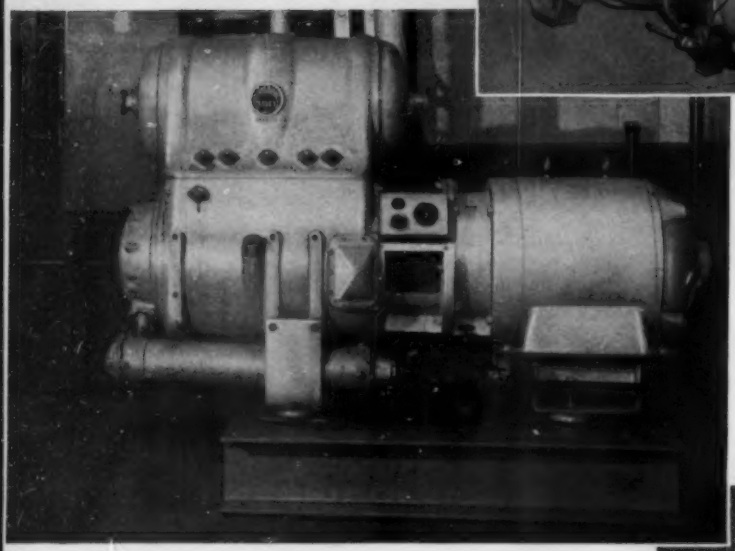
And because the Skil Model 701 has the *right* speed for any metal-cutting job, blades last longer—you save more money!

SKIL . . . and SKILSAW POWER TOOLS

Circle 582 on postcard, page 33

a famous boat manufacturer

Lone Star Boat Company,
Plano, Texas

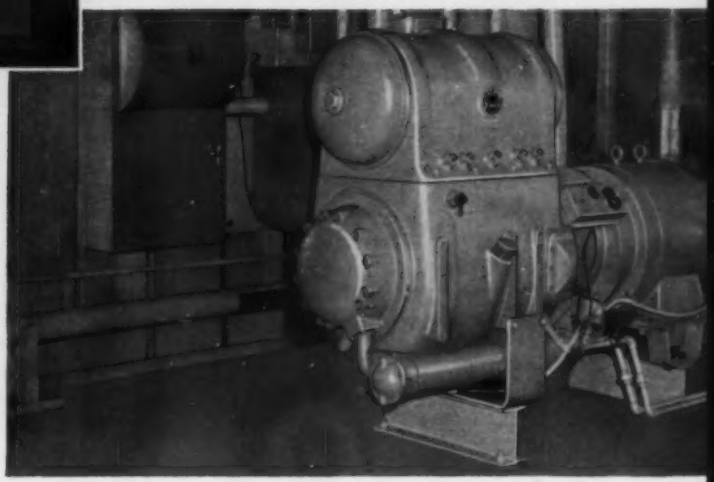


a maker of fine cutlery

Clauss Cutlery Company,
Fremont, Ohio

and a railroad service shop

Clinchfield Railroad Company,
Erwin, Tennessee



use DAVEY **Rotary Air Compressors** *to speed production*

Industry today has a new air compressor, with superior performance and fewer operating parts—50% less. Designed for high speed production, Daveys are easier to install, dependable to operate, economical to maintain.

In 2 to 150 h.p. sizes, water or air-cooled, they are self-enclosed. No exposed belts or couplings. Oil consumption is no greater than ordinary reciprocating machines—often only 10% of other rotary compressors.

Only Davey offers *long life* Perma-Vane blades. Patented, used exclusively by Davey, these stop blade deterioration and breakage . . . eliminate the biggest cause of rotary compressor trouble.

Write for Bulletin E.

DAVEY
built to serve and endure

Industrial Division
DAVEY COMPRESSOR CO. • KENT, OHIO

Circle 583 on postcard, page 33

WHEN THE PROBLEM CALLS FOR PAINT THE BEST ANSWER

IS INVARIABLY **Barreled Sunlight** ENGINEERED Paints

Washability is a major consideration in the selection of industrial paints — particularly where good housekeeping practices and high visibility standards demand frequent floor, wall and ceiling "scrubdowns".

The trick is to select paints which not only resist the abrasive action of water and cleaning compounds but which are *engineered* to provide maximum painting economy as well. And *this* is why the recommendations of Barreled Sunlight Engineered Paint representatives are acted upon so many times in so many plants. On job after job, the paints they recommend more than meet the toughest tests . . . *invariably* provide a better looking, longer lasting paint job at lower cost.

It will cost you less — now and in the long run — to talk over your plant paint requirements with a Barreled Sunlight representative. The coupon below is your invitation for a free consultation without obligation.

FREE! BARRELED SUNLIGHT PAINT "SLIDE GUIDE"

Contains complete information on Barreled Sunlight Exterior and Interior Finishes, Colors, Primers, and Thinners plus full application and special resistance data.

BARRELED SUNLIGHT PAINT COMPANY
1257 Georgia Avenue, Providence 5, Rhode Island

I want to learn more about Barreled Sunlight Engineered Paints and what they can do for us.

☐ Please have your representative call me to arrange an appointment without obligation.

☐ Please send me your new "Slide Guide" to Barreled Sunlight Paints.

Name.....

Title.....

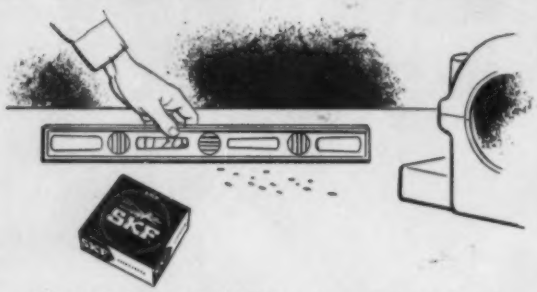
Company.....

City.....*Zone*.....*State*.....

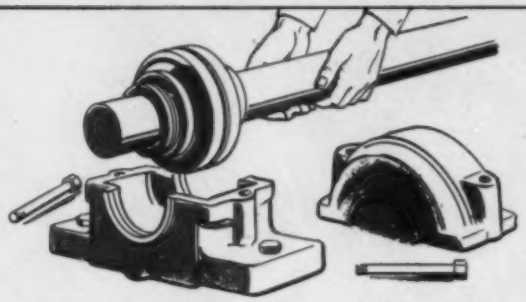
Circle 584 on postcard, page 33

DISTRIBUTOR DAN, the SKF bearing man, says:

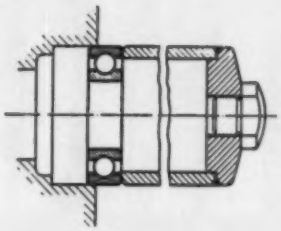
"TEAR OUT THIS PAGE AND READ IT BEFORE YOU INSTALL A BEARING"



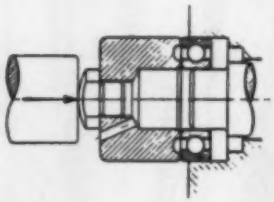
CHECK THE HOUSING SUPPORT first, for surface flatness and horizontal alignment. Then check the housing for correct position. Both checks are vital if you have to mount a non-self-aligning bearing in an independent housing.



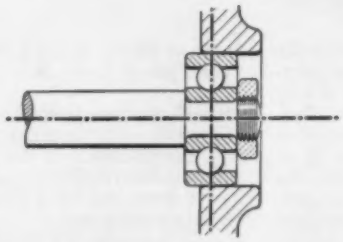
WITH SPLIT HOUSINGS, you simply lower shaft and bearing into the bottom half. Then secure the top half. Straight-through solid housings use bearings with rings that fit loosely with the housing, enabling you to push shaft and bearing into position.



BEARINGS THAT FIT LOOSELY on the shaft generally have a tight fit in the housing. In this case, mount the bearing in the housing by knocking on a mounting sleeve or by pressing. Then insert the shaft into the bearing.



BEARINGS WITH TIGHT FITS on the shaft and in the housing are usually mounted by fitting both rings simultaneously. Apply force to both rings but make sure it isn't carried to the rolling elements. Make sure the mounting sleeve and rings are flush.



START IT SQUARE. When you install a bearing in a solid housing, make sure the bearing is square with the shaft. If it enters obliquely, the more you try to seat the bearing the more trouble you'll have in moving it.

THE SERVICE OF AN AUTHORIZED SKF DISTRIBUTOR GIVES YOU THE BIGGEST BARGAIN IN BEARINGS!

SKF MOTION ENGINEERING

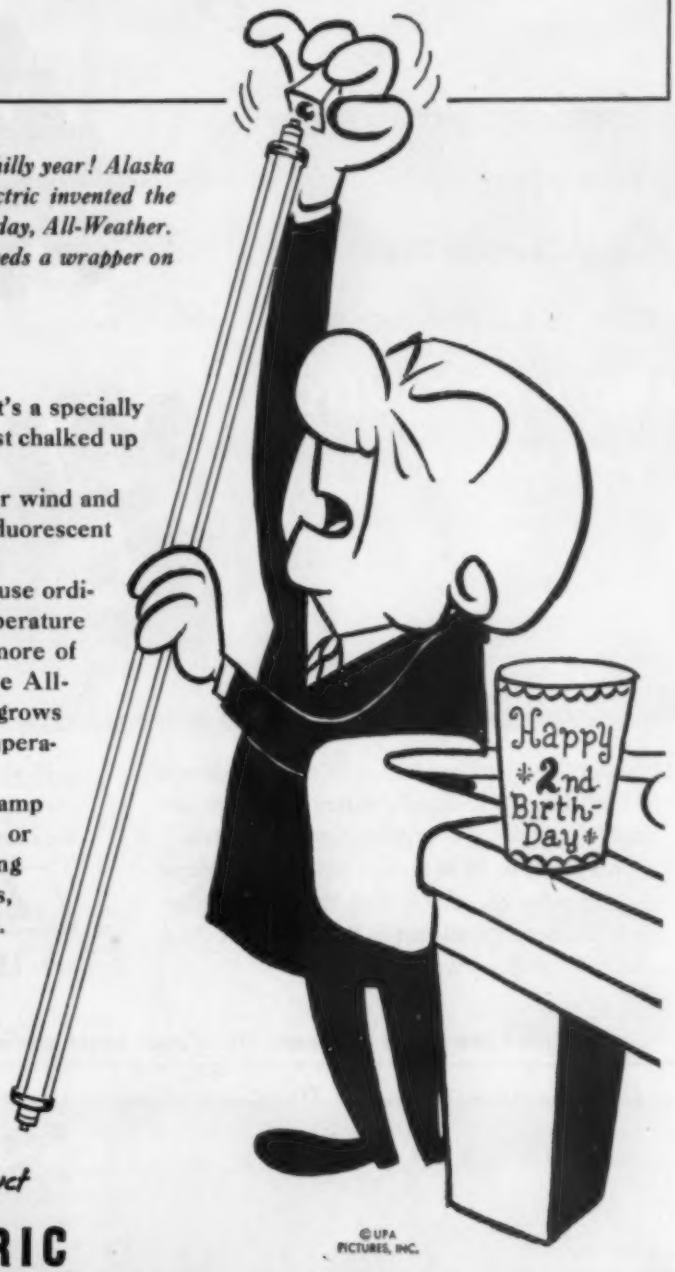
Advanced ball and roller bearing technology

Circle 585 on postcard, page 33

First from General Electric (1959)...another bright idea that became a better lamp for you

G-E All-Weather Fluorescents shine brighter when mercury drops

Mister Magoo says . . . "1959? A chilly year! Alaska joined the Union, and General Electric invented the All-Weather fluorescent. Happy birthday, All-Weather. Humph! Packaging experts! Who needs a wrapper on a pool cue?"



DON'T drop your cue, Mister Magoo. It's a specially jacketed All-Weather lamp, another first chalked up by General Electric.

It wears that glass jacket to ward off winter wind and cold. Below freezing, it's the most powerful fluorescent lamp you can buy.

General Electric developed this lamp because ordinary fluorescents grow dim when the temperature dives toward zero. Often they lose 90% or more of their warm-weather light output. But the All-Weather fluorescent T10J—a G-E exclusive—grows brighter the colder it gets! Use it where temperatures sometimes drop below 50°F.

You can use the T10J—or its companion lamp (T10) without the "storm window"—indoors or out. Examples: walk-in freezers, shopping centers, drive-ins, parking lots, street lamps, store fronts, airports, docks, signs, gas stations.

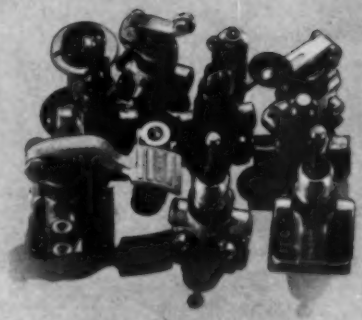
Both come in 4′, 6′, and 8′ lengths. Ask your G-E distributor to show you these two exclusive examples of General Electric lighting leadership. General Electric Co., Large Lamp Dept. C-111, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Circle 586 on postcard, page 33

why does Logan stock so many AIR AND HYDRAULIC VALVES?



Logan offers a wide selection in size and design of both air and hydraulic valves to meet a demand that has steadily grown over the years.

This effort to be of service beyond the design and manufacture of air and hydraulic equipment has been a vital part of the Logan program since the company was founded.

If you would like more information about valves, or other Logan products, merely fill in the coupon below.

LOGAN

AIR AND HYDRAULIC OPERATED MACHINES

Check the items you want, fill in your name and address, tear out and mail to:

Logansport Machine Co., Inc. · 760 Center Avenue, Logansport, Indiana

__100-1 AIR CYLINDERS
__100-2 MILL-TYPE AIR CYLS.
__100-3 AIR-DRAULIC CYLS.
__100-4 AIR VALVES
__100-5 LOGANSQUARE CYLS.
__100-6 ULTRAMATION CYLS.
__100-7 SUB-PLATE AIR VALVE
__300-1 CHUCKS
__300-2 PRESSES
__200-1 HYD. POWER UNITS
__200-2 ROTOCAST HYD. CYLS.
__200-3 750 SERIES HYD. CYLS.
__200-4 and 200-7 HYD. VALVES
__200-6 SUPER-MATIC CYLS.
__ABC BOOKLET
__CIRCUIT RIDER
__CALCULATOR
__FACTS OF LIFE

Please send copy of catalog

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

Circle 587 on postcard, page 33

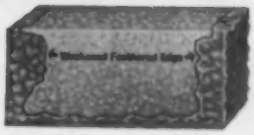
Hold That Jackhammer...SAW FIRST AND SAVE!

use a Clipper "SAILS RIGHT THRU" CONCRETE SAW No need to cut a trench wider or deeper than the electric conduit, water, gas, sewer or steam line to be installed. Saw to repair damaged floors. Sawed joints in floors are smoother, last longer. Less material to remove, less to replace. Using jack hammers, minimum width of the openings is 14" with uneven edges causing future maintenance . . . also "clean-up" cost often amounts to more than the job itself. That's why manufacturing and processing plants, food, machine tools, newspaper —industrial plants of all types—use Clipper even while operating. CALL COLLECT for FREE DEMONSTRATION.

Get a perfect patch
LIKE THIS...

Note smooth, straight edges. Replacement material bonds better, patch lasts longer . . . water seepage eliminated. Sawed joint resists damage even under constant impact of steel wheel traffic.

Instead of one
LIKE THIS...



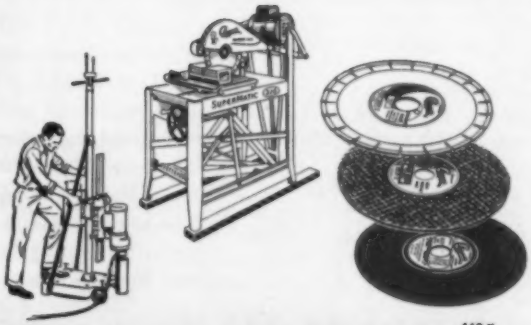
The weakened, feathered edges of this jagged patch job will chip and flake. Very possibly radial cracks far beyond repair area will present trouble here too. In all, it's a patch that won't last.

ask too about...

CLIPPER CORE DRILLS AND BITS World's first diamond core drills with sufficient speed and power for truly successful drilling of all types of masonry material, including the toughest reinforced concrete.

CLIPPER MASONRY SAWS cut every shape and size refractory and masonry material, wet or dry, in seconds—give you perfect reline jobs. Let a Clipper factory-trained representative show you in your plant why Clipper is the choice of 4 out of 5 Masonry Saw owners.

CLIPPER BLADES diamond and reinforced abrasive, for concrete and masonry saws. Can save you as much as 30%. Clipper blades saw more concrete and masonry materials than any other blades in the world.



443 X

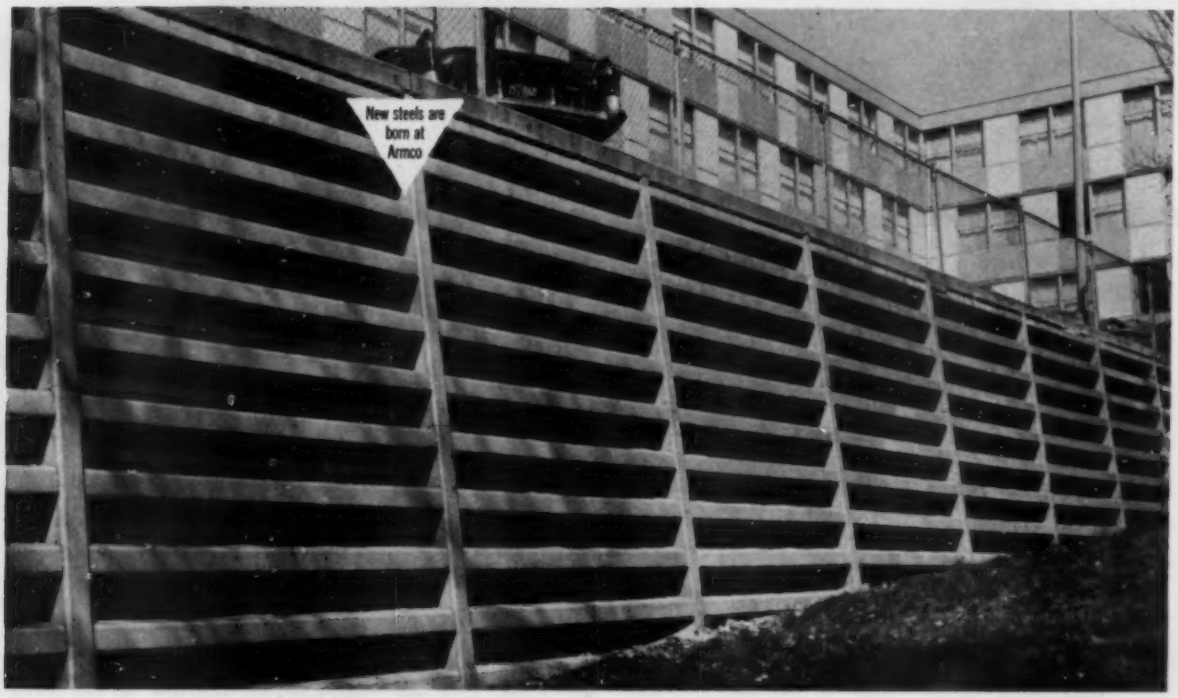
Clipper "SAILS RIGHT THRU" MANUFACTURING COMPANY
General Offices and Factory, 2800 Warwick Blvd., Kansas City 8, Mo., Phone GRand 1-0766.
Sold direct from offices and warehouses coast to coast.
Factories in England, France, Germany, Australia and Italy.

Circle 588 on postcard, page 33

Here's why Industry selects Armco Retaining Walls

"Our engineers chose an Armco Retaining Wall because it was less costly than concrete, and easier and faster to install."

"An Armco Retaining Wall cut our costs almost in half."



Armco Retaining Wall helps provide parking area on sloping lot at rear of commercial building.

Officials of two industrial companies made the above comments about Armco Bin-Type Retaining Walls.

These all-steel walls consist of deeply-corrugated members. Bolted together, they form a connected series of cellular bins. Material compacted inside these bins provides stability. There is no formwork, no waiting for curing. Costs are low. Work goes fast.

Armco Retaining Walls are used by industry to provide parking areas, utilize wasted slopes, or gain maximum right-of-way without encroachment. Write for catalog. **Armco Drainage & Metal Products, Inc., subsidiary of Armco Steel Corporation, 6851 Curtis Street, Middletown, Ohio.**

Steel

For strength, economy, durability

ARMCO Drainage & Metal Products

Circle 589 on postcard, page 33

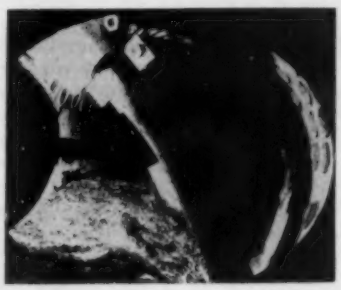
Hall Industrial Water Report

VOLUME 9 JULY 1961 NUMBER 2

There's nothing fishy about scale

Ask the power engineer who has boilers down because of blistered tubes. The maintenance man who has to push a screaming turbine through the dirty tubes. The refinery superintendent who has to stop a campaign because of scale. Or the plant manager who has to approve the bills for acid cleaning.

Deposits formed from water range from simple to complex compositions. Some are easy to prevent. Others are a real challenge. Hall engineers know what each constituent means and the water conditioning procedures which are effective in controlling deposition in power plants, cooling systems, service water systems, or manufacturing processes. They can help you.



Before and after

The "Before" picture shows the mud drum of a boiler in a midwestern machinery plant almost half full of scale. This was the condition found after operation for one year with presumably good boiler water conditions.

After cleaning the boiler as thoroughly as possible by mechanical means, the operators retained Hall Laboratories. Hall field engineer J. D. Crail studied the problem and helped the operators set up protective water conditions.

There was enough scale left in the boiler to double theoretical chemical consumption for almost six months. Then chemical feed dropped steadily. When the boiler was opened after approximately ten months, everyone was happy to find the condition shown by the "After" picture. Scale formation was no longer a problem.

Poor testing

Hall field engineer C. H. Turner was asked to investigate a rash of boiler tube failures at a midwest paper mill. He found that the failures were due to a type of scale that will not form in the presence of an adequate amount of phosphate in the boiler water—but the plant reported that phosphate concentration had been satisfactorily maintained.

Turner suspected the phosphate testing procedure. A check quickly determined that an important step in the phosphate test was being omitted, and phosphate feed was actually insufficient to prevent scale formation. Considerable trouble and expense could have been avoided if Hall service had been available *before* the tube failures occurred.

Time marches on

A metals refining plant has been a satisfied client of Hall Laboratories for more than twenty years. But Hall has not been completely happy with results.

Hall field engineer R. A. Beardsley knew that he could get cleaner boilers. However, he could not generate enthusiasm for the necessary changes, because results were good enough to prevent serious trouble.

Beardsley finally broke the barrier. Boiler water conditions were modified, modern chemical feeding equipment was installed and testing procedures and equipment were brought up to date.

The changes paid off. The next insurance inspection report was the best ever. Hall engineers are constantly applying new procedures and ideas to old problems.

Dirty jackets

Well water, high in temporary hardness, is used for cooling diesel engines under test at an eastern engine manufacturing plant. The duration of test runs is only about 18 hours over a two-day period, yet calcium carbonate scale built up rapidly enough to result in engine overheating and damage. Jacket cleaning with acid before shipment was standard practice.

When Hall field engineer D. C. Altenburger tackled the problem, he found that he would have to consider oil contamination of the cooling water as well. Furthermore, if he used threshold treatment with sodium hexametaphosphate to control precipitation of calcium carbonate, he would be in trouble with calcium phosphate deposits because of the high temperature (175-185°F) of the circulating water.

Altenburger concluded that he would use threshold treatment, plus an organic dispersive for calcium phosphate, plus a wetting agent to combat the oil. Results have been excellent. Deposits are a thing of the past and there is no longer any engine damage during test runs or need for cleaning.

For your copy of 24-page brochure describing the many ways industry can use Hall Industrial consulting service, write to:

HALL LABORATORIES
HAGAN CENTER, PITTSBURGH 30, PA.
Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.

Circle 590 on postcard, page 33

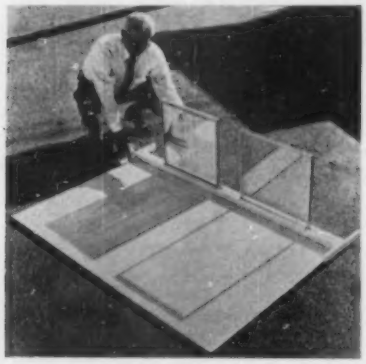
PLANT ENGINEERING EQUIPMENT.

Edited by M. E. Heniken

Use the Reader Service Cards provided on pages 33-34 to ask for more information on this equipment. Circle item numbers of products in which you are interested.

GLASS UNIT controls sun heat and glare

Solarshade incorporates a pre-framed louvre shade screen between two panes of glass that are hermetically sealed. The pre-framed screen is located per-



manently in the dead air space of the thermal unit, the entrapped air being at atmospheric pressure. Solarshade controls solar heat and sky glare in window and wall construction, providing advantages of a louvred shade screen and insulating values of a dehydrated and sealed glass unit. No maintenance beyond normal window care required. Armour Glass Co.

For details, circle 1 on Post Card

TILE transforms roofs into serviceable area

Promenade Tile, an asbestos - cement product, transforms built-up roofing surfaces into areas suited for heavy foot traffic. At the same time, the tiles keep the felts of the roof from losing their oils and deteriorating from the sun. Also, the natural light gray color of the tile is reflective and minimizes heat absorption. Promenade Tile is installed on a trowelled-on cold asphalt cement base in an operation similar to installing interior plastic tile. It can be cut with a hack saw or scored for breaking, and can be fitted around irregular shapes. A standard 12-by-12-by-5/16 in. unit weighs only 3.40 lb. Installed cost is given as $1.25 per square foot. Keasbey & Mattison Co.

For details, circle 2 on Post Card

PIPE COATING SYSTEM includes primer and asphalt

This improved pipe coating system involves use of a new primer (Lion 5-A-60) and asphalt pipe coating (Lion E-120-A). Cathodic disbonding tests are reported to show superior performance in comparison with other commercial coatings. Claimed for the asphalt coating are easier handling and faster application, due to improved resistance to deformation and more rapid set-up time, as well as flexibility at low temperatures and sag resistance at high temperatures. The rapid-drying primer is said to have improved adhesive qualities as well. Lion Oil Co.

For details, circle 3 on Post Card

MODULAR UNITS provide work space as needed

Modulite is a planned modular work space system utilizing a basic pedestal and components of three door sizes, two drawer sizes and shelves. Of steel construction, finished in gray with black trim, these units are used with Granilite or other work surfaces. Combining components in different arrangements enables planning of work stations to serve any requirement. Completed units are shipped assembled as ordered, but can be converted to new combinations with a screw driver. Components can be added, removed or respaced. Each component is sized in multiples of five units and any com-

bination totalling 20 units can be used. In the arrangement illustrated, the pedestal at left holds two five-unit drawers and the one at right, four five-unit drawers. Top is black Granilite. Sturdilite Products, Inc.

For details, circle 4 on Post Card

TREATMENT UNIT controls cooling tower corrosion

Cal-Treat 211 controls corrosion in small evaporative condensers, cooling tower systems. Packaged in 1-gal self-feeding cans, it introduces a constant rate of treatment for about 30 operating days. To install, the feeding can is placed in the sump usually under the make-up water valve, and, if necessary, a ¼- or ⅜-in. plastic or copper tube attached to the top of the can to carry water from the recirculating line to the can. A bleed-off of 1 gph/ton of cooling capacity is recommended for most waters. Calgon Co.

For details, circle 5 on Post Card

WASHER is low cost, self-contained unit

The Weaver Wash-All is a simple, inexpensive unit for cleaning motors, machinery, parts and assemblies, as well as floors and walls. Of non-cor-

rosive brass and plated steel, with only one moving part, this washing unit is described as easy to operate and virtually maintenance free. Air-powered at recommended pressures of 150 to 175 psi, it can be mounted in a standard open-top 55-gal metal drum, and has wide and narrow spray nozzles. Weaver Mfg. Div., Dura Corp.

For details, circle 6 on Post Card

ALARM ROTAMETER requires less headroom

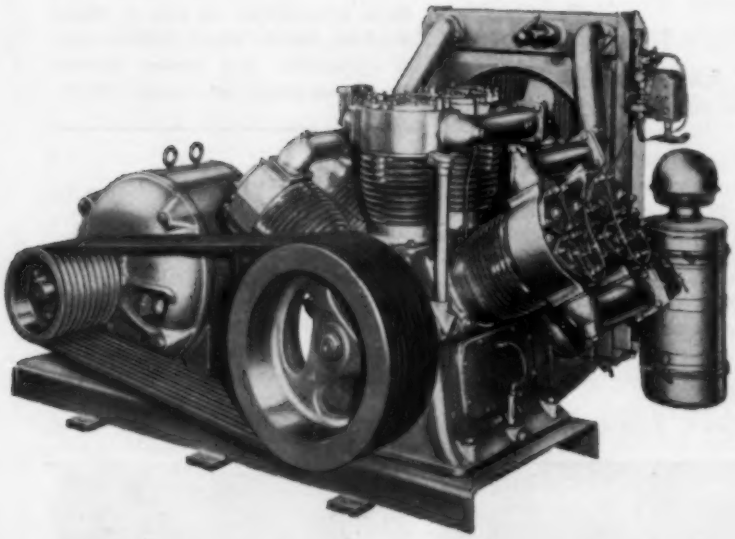
Fig. 1900-F-CDA Rotameter features a space saving design in which the visual indicating element and alarm system are included in one housing. The unit consists of a standard metal-tube rotameter for measuring fluid rate of flow and an alarm system, the latter including a magnetic indicator and alarm switches mounted in a weather-

Make LE ROI your one-stop source for AIR COMPRESSORS

WESTINGHOUSE unit type ½ to 15 hp. 17 models: 2 to 71.7 cfm—80 to 250 psi

WESTINGHOUSE single- and two-stage compressors are ideal for jobs in the unit type class with moderate air demand. You get long-lived dependability at low first cost. Upkeep is negligible. Units incorporate thermal overload protection, positive starting unloader, air cooled deep-finned cylinders, and corrosion-resistant automatic spring loaded floating valves.

Crankshaft is ball-bearing mounted for stability, and matched V-belt set assures balanced drive line wear. Compressors are available with horizontal or vertical tank, or bed-plate mounting. Load-unload or start-stop control is standard. Options include dual control, water-cooled aftercooler, and automatic drain valve for receiver.



LE ROI stationary type 25 to 100 hp. 4 models: 92 to 450 cfm at 125 or 175 psi

LE ROI stationary compressors provide economical and flexible air power for your heavy industrial jobs. Made in 25, 50, 75, and 100 hp sizes, these two-stage units can be used as central air supply — or you can spot units at various points of use, thus minimizing pipe runs and air loss. Air-cooling permits indoor and outdoor use, and compactness conserves space.

Features like forced-feed lubrication, large intercooler, high-speed fan, and balanced design extend motor and compressor life and cut upkeep. You can pick standard models with either dual control or continuous running load-unload control. Option extras include: crankcase oil filter, oil pressure safety switch, intake silencers, belt and intercooler guards, and water-cooled intercooler.

Ask your Le Roi Distributor for additional information. Or send for Bulletin SG-3 covering the entire line. Write to Le Roi Division, Westinghouse Air Brake Co., Sidney, Ohio.

96-102

LE ROI Division of Westinghouse Air Brake Co. Sidney, Ohio

Circle 591 on postcard, page 33

PLANT ENGINEERING EQUIPMENT

(Begins on page 170)

proof housing. The unit can be equipped with one or more alarm switches and with 10-amp relays when required. In operation, alarm switches are set for maximum and minimum flow. When flow is higher or lower than the settings, the switches activate a light, bell or other alarm, a start-stop switch or other control mechanism. Schutte and Koerting Co.

For details, circle 7 on Post Card

CRADLE MOUNTED PUMPS for chemical services

These centrifugal pumps can be used on almost any chemical or processing service requiring a pump to handle both corrosive and non-corrosive liquids. Maximum interchangeability

of parts is provided in pumps of the same size which can be had in alloy, ferrous and non-ferrous metals. Three models range in capacity from ¼ through 50 hp, with delivery up to 1000 gpm, total head to 240 ft. All casings are of vertically split design. Cradles on these pumps use oversized ball bearings which are oil-mist lubricated. The pumps may be driven by any dependable source of power through a flexible coupling, gear or belt and sheave arrangement. Form 70288 gives data. Ingersoll-Rand Co.

For details, circle 8 on Post Card

TEFLON HOSE equipped with reusable fittings

Type T4 Hose, with reusable type fittings that can be made up into assemblies on-the-job with ordinary hand tools, has a core of Teflon, covered with stainless steel wire braiding for strength and durability. Fittings are cadmium-plated brass NPT males. Available in sizes from ⅛- to 1¼-in. ID, this hose conveys steam, fuel, lubricants, hydraulic fluids etc., under conditions of movement and vibration. It is lightweight, chemically inert and withstands temperatures from —650 to 450 F. Anaconda Metal Hose.

For details, circle 9 on Post Card

FIRE EXTINGUISHER is low priced and high rated

The pressurized Kidde Kompact is a 2½-lb dry chemical unit carrying a suggested retail price of around $12.00. According to manufacturer, its UL rating of 4-B:C is the highest given any extinguisher of its capacity. Features are fast, self-evident operation and easy recharging. It is 14 in. high, 3 in. in diameter and weighs 5 lb charged. Walter Kidde & Co., Inc.

For details, circle 10 on Post Card

DISPOSABLE FILTER removes industrial odors

Disposable Odor Remover Dacor 5D consists of a gridwork of activated charcoal coated fiber strips in a paperboard frame. Used in forced air ventilating systems, the economical, lightweight filters have low resistance to air, come in standard furnace sizes. Bulletin E-190 describes this product. Barnebey-Cheney Co.

For details circle 11 on Post Card

HEAT EXCHANGER increases usable compressed air volume

Economat combines an aftercooler and cyclone separator with a feature to restore 1/3 the usable compressed air volume that would be lost in cooling. Compressed air passing through aftercooler to remove water and oil vapors decreases in volume. The Economat, using the original heat of compression to reheat the air, restores 1/3 of this volume at 50 lb pressure and develops a dew point as low as 20 F. R. P. Adams Co., Inc.

For details, circle 12 on Post Card

FAN COIL UNITS for zone controlled conditioning

Airditioner fan coil units, providing central-system air conditioning with individual room controls, come in 11 types and six colors. Equipped with a high-capacity coil and quiet blower fans, the units heat, cool and dehumidify, ventilate, or circulate air in a room according to individual preferences.

The same piping system, connected to a central source, supplies hot water to the coil for heating and chilled water for cooling. If neither heating nor cooling is required, air can be circulated by the blower fans. Temperature in each room can be controlled manually or with a room thermostat.

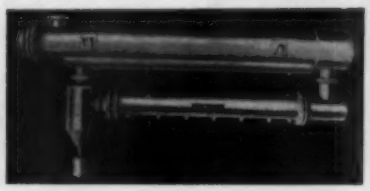
Air flow capacities range up to 1500 cfm. and models are available for mounting on the floor, on the wall or concealed in the wall. In addition to attractive styling, the units are designed for easy installation and maintenance. An optional feature is an automatic push-button lubrication system. Modine Mfg. Co.

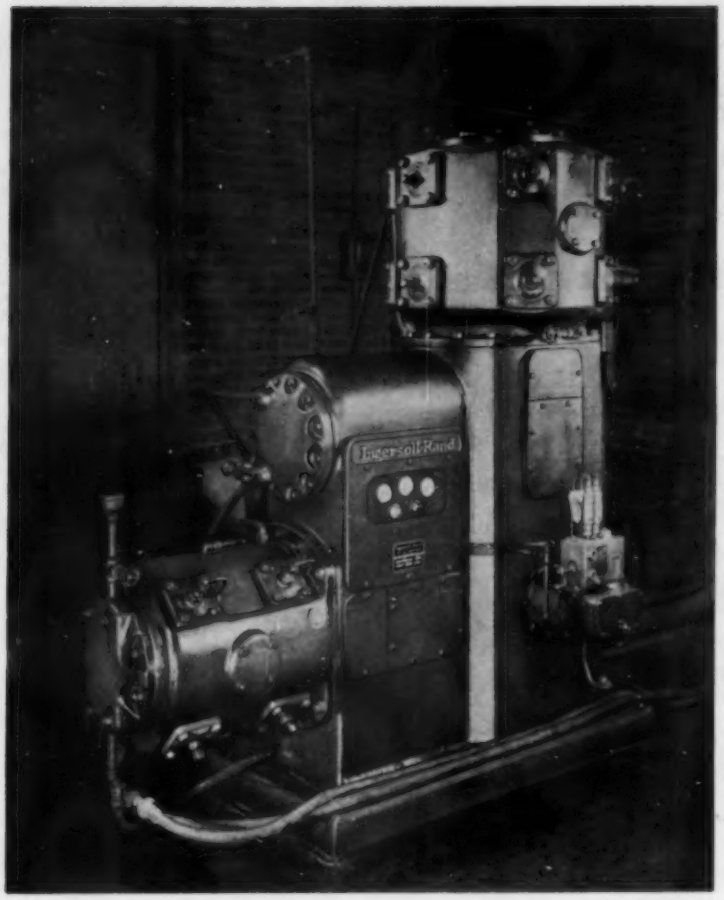
For details, circle 13 on Post Card

More information on any of these products can be yours without cost or obligation. Use reader Service Cards provided on pages 33-34.

ROOF VENTILATOR directs exhaust horizontally

Centridyne Centrifugal Roof Ventilator features aerodynamically extruded aluminum discharge vanes which redirect air flow horizontally to prevent roof damage or deterioration. Offering straight-line styling and low silhouette, Centridyne also features quietness of operation, non-overloading





IN I-R COMPRESSORS,
TIME TELLS
THE DIFFERENCE

This XLE compressor has operated 24 hours a day for more than

63,648 HOURS

with no forced maintenance since installed in 1951

At the Conshohocken (Pa.) plant of the Lee Rubber & Tire Corporation, this Ingersoll-Rand XLE air compressor has operated at full load, 24 hours a day, six days a week, with no forced shutdowns since installed in 1951. At this writing, the unit has totalled 63,648 hours and is still going strong!

The only maintenance has been to check the valves once every three months on Sunday. This XLE operates as the plant's base-load air compressor, with the load variations being handled by another unit.

The XLE compressor had been purchased largely because of good performance of other I-R equipment in the same plant, including three different types of compressors and a variety of pumps.

The *extra value* that's built into every Ingersoll-Rand compressor pays off with *long-run economy*. Reduced maintenance and attention, over many years, mean long-range savings in the cost of air power. Ask your I-R representative to show you how to get your maximum *"Dividend on Payroll Dollars"* with a Planned Annual Review of your air power system.

***ONLY IR COMPRESSORS HAVE CHANNEL VALVES**

Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of rigid stainless-steel channels and bowed leaf springs, with trapped-air spaces which cushion action, prevent impact.

Ingersoll-Rand

110-A-1 11 Broadway, New York 4, N.Y.

THE WORLD'S MOST COMPREHENSIVE COMPRESSOR EXPERIENCE

Circle 592 on postcard, page 33

PLANT ENGINEERING EQUIPMENT

(Begins on page 170)

horsepower and a stable pressure curve. All construction is aluminum except motor-wheel support structure which is of rigid tubular steel, vibration insulated. Wheels are statically and dynamically balanced. Models range from ⅛ to 5 hp. Western Engineering & Mfg. Co.

For details, circle 14 on Post Card

COMPACT ELECTRIC CAR hauls operator and load

The 182-lb, 30-in.-wide Delwick has an integral carrying space for loads up to 100 lb, or an additional passenger. It is driven by a 12-v electric motor operated by a foot switch and powered by a lead-acid battery with trickle charger. The car can be operated for a

full shift and recharged in 12 hr by plugging the charger into a 110-v circuit. Forward speed is set at 5 fpm. The car has a welded tubular steel frame, one-piece fiber glass molded body available in several colors. The car itself is 53 in. long, has a 60-in. turning radius.

For use with it is a 38-lb trailer, 26 in. wide and 50 in. long. A group of trailers can be used to move loads under 250 lb where fork lift trucks are uneconomical. Both car and trailer have anti-friction bearing wheels with pneumatic tires. The car costs around $400; the trailer, $50. Namisco, Inc.

For details, circle 15 on Post Card

FLOOR COATING, non-skid, non-sparking, dries overnight

Tuf-Quik Skid-Grip is claimed to assure safe footing on floors, stairs and ramps. It comes ready-mixed for immediate application over painted or bare wood, concrete and metal, in- and out-of-doors. It dries overnight for heavy traffic. The coating provides a non-sparking surface in fire-hazard areas, manufacturer states; it has a coefficient of friction of 85-90 per cent on wet and oily floors and is chemically resistant to repeated spillage of common industrial compounds. It is available in two grays, red and green. Wilbur & Williams Co., Inc.

For details, circle 16 on Post Card

PIPE INSULATION JACKET resists fire, humidity

Flame-Bar, a white embossed flame-retardant vapor-barrier jacketing for pipe insulation is reported to have a UL flame spread rating of 25. It can be obtained on company's Micro-Lok, Fibrocel and Thermobestos insulations. According to manufacturer, Flame-Bar incorporates all good characteristics of other flame-retardant jackets, with no wrinkling under high humidity conditions, yellowing with age, or pinholes. Of three-ply construction it has an outer layer of 35-lb bleached embossed kraft bonded to aluminum foil with a flame-extinguishing adhesive. It is reinforced in lamination with fiber glass yarn. It has a water permeability rate of 0.01 perms and can be painted or color coded. Industrial Insulations Div., Johns-Manville Corp.

For details, circle 17 on Post Card

SAFETY SWITCHES come in raintight enclosures

Red-handled safety switches in raintight NEMA Type 3R enclosures offer two convenience features. The first lets an installer remove the switch cover quickly by loosening just two screws. Rugged cover supports are the second feature — they hold the front cover up, letting an electrician use both

hands when servicing the device. Both light duty (Type TG) and heavy duty (Type TH) raintight switches are available in same ratings as indoor devices: 30 through 600 amp, 240 and 600 v a-c. They provide the same performance and safety characteristics as company's indoor NEMA Type 1 line, including heavy duty ability to withstand 200,000 amp short circuits. Provision for interchangeable raintight conduit hubs has been made in devices up to 200 amp. General Electric Co.

For details, circle 18 on Post Card

ANGLE DRIVES offer many new advantages

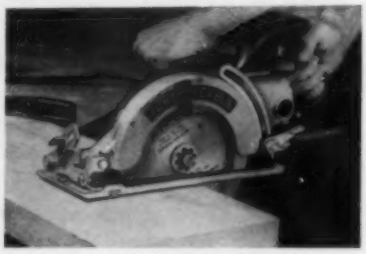
The 9056HF (T-drive) and 9056-119 (right angle drive) are constructed to provide stronger attachments for coupling ends, with ¼-in. diam shafts cut

to 1/16-in. flat. For use with flexible shafting, they allow for a wider variety of application than flexible shafting alone, have an ultimate static torque capacity of 25 lb/in. with 6-deg backlash. Weights are 4 oz. for T-drive and 3½ oz. for right angle drive. F. W. Stewart Corp.

For details, circle 19 on Post Card

TORQUE SAW, lightweight, does heavy-duty service

Model 568 is an improved 7½-in. high torque saw with worm gears for extreme loads. The housing, of light-

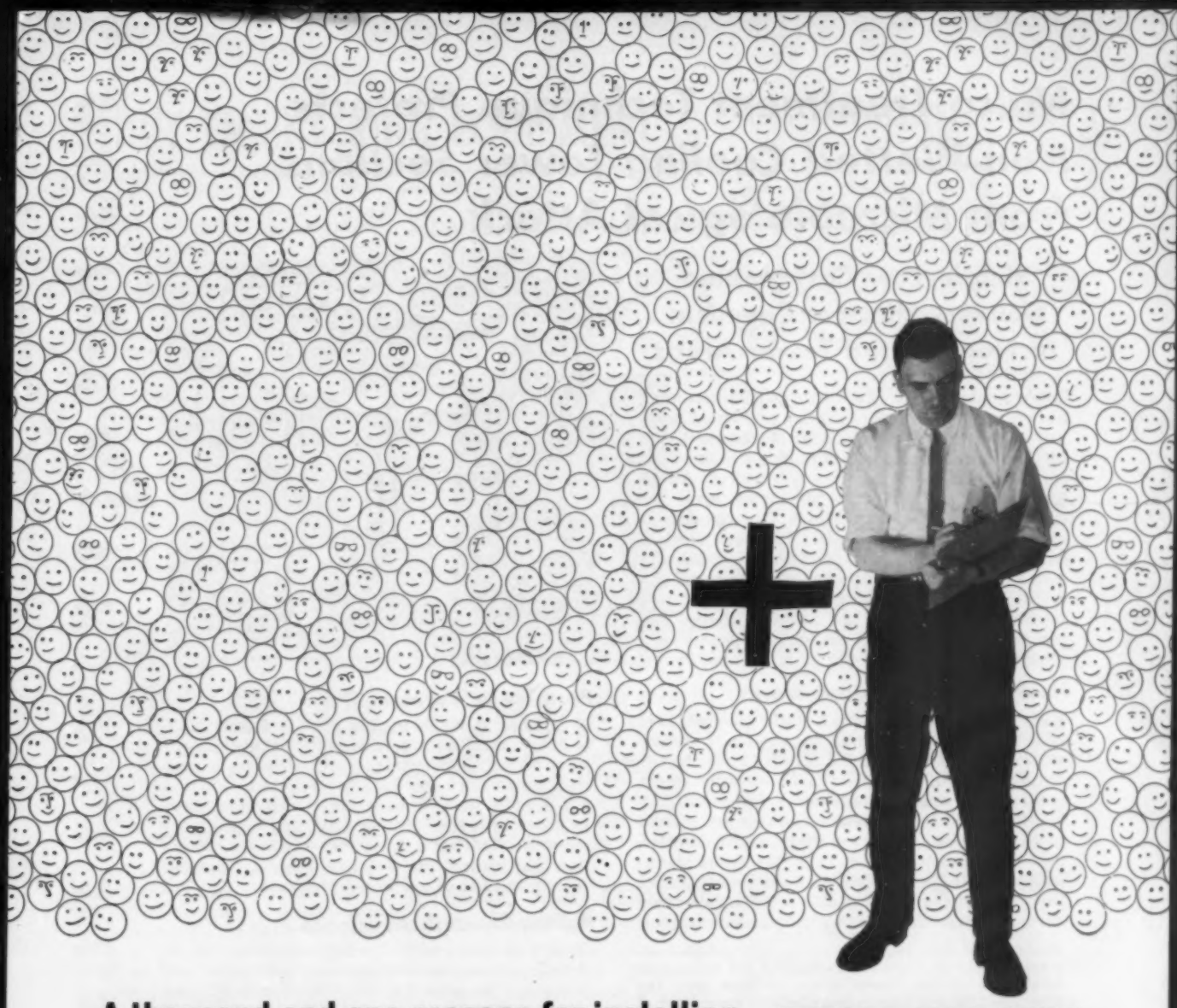


weight aluminum alloy, has a no-drag telescoping guard. A micro-adjustable clutch can be set for any degree of "slip" or locked without slip. Porter-Cable Machine Co.

For details, circle 20 on Post Card

AIR PRE-HEATER makes the fuel go further

For mounting on the fire door of oil- and coal-fired boilers, the Little Devil is claimed to reduce fuel consumption up to 25 per cent. A chrome-nickel casting, it has no moving parts, presents no maintenance problems. Utilizing heat reflected from the fire, the unit heats the air drawn in over the baffles within it. This heated air, which reach-



A thousand and one reasons for installing

USS Multigrip Steel Floor Plate

If you have a thousand employees you have a thousand reasons for installing USS Multigrip Safety Floor Plate. But accidents can happen to anyone, so you'll be protecting yourself, too. Covering all the danger spots in your plant may prevent costly accidents. The riser pattern on USS Multigrip is scientifically designed to give positive traction in all directions, wet or dry. And Multigrip has no closed pockets to collect dirt and water—it sweeps clean in a stroke.

Multigrip protects floors, too. These rugged, heavy-duty floor plates will take the pounding of heavy traffic year after year with little wear or maintenance. Multigrip can't chip, splinter, or crack. It comes in $\frac{1}{8}$" to $\frac{1}{2}$" thick plates up to 600 inches long, so is easy to install without waste. Your Steel Service Center representative will provide you fast delivery of any size Multigrip Steel Floor Plate. Contact him for more information or write United States Steel, 525 William Penn Place, Room 6282, Pittsburgh 30, Pennsylvania.

This mark tells you a product is made of modern, dependable Steel.

United States Steel Corporation • Columbia-Geneva Steel Division • Tennessee Coal & Iron Division • United States Steel Export Company

USS TRADEMARK

United States Steel

Nalco Treatment Technique Protects Non-Wetted Cooling Tower Sections from Microbiological Attack

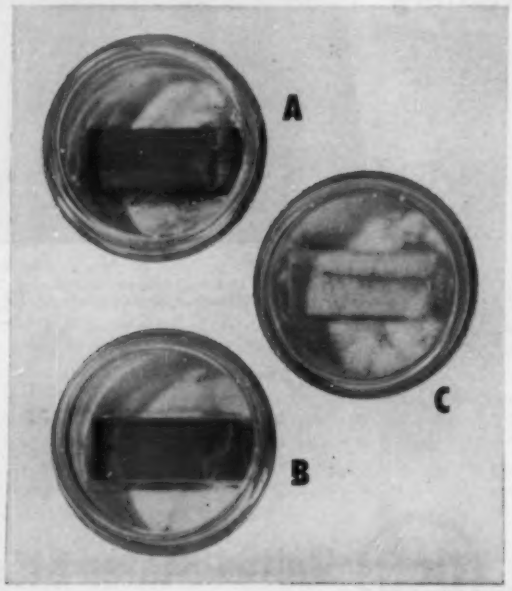
Simple, Low-Cost Method Delivers Effective Chemical to Non-Wetted Tower Areas

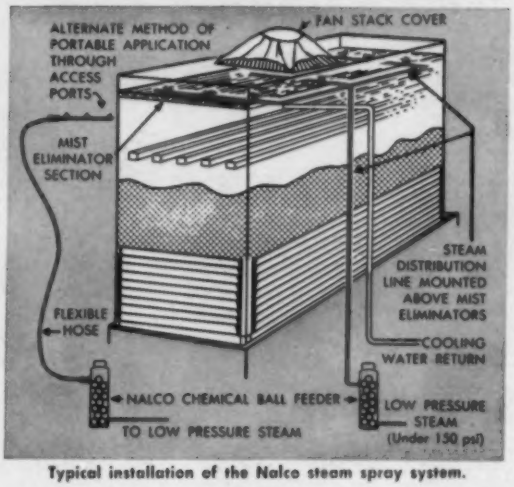
Tower sections above the water distribution level have presented a tough protection problem. Chemicals in the water rarely reach fan stacks, top decks, plenum chambers and mist eliminators in sufficient concentration to be completely effective. All of these areas are subject to damaging wood rot caused by microbiological attack. Consequently, a difficult manual spray method has been used to combat this problem. Nalco now recommends using a steam application method to carry powerful microbiocides into the non-wetted areas as a positive method of reaching *all* non-wetted surfaces. The technique is simple, low-cost, and has proved very effective in keeping non-wetted lumber rot-free.

How Steam Treatment Works

Fans are shut down, and fan stacks covered. It is possible to circulate water in the tower during steam treatment, but faster results can be had if circulation is also stopped. Low pressure steam is directed through a container of *Nalco* ball briquette microbiocide chemicals, which are carried with the steam. Perforated steam pipes, inserted into the plenum chamber, carry the steam chemicals into all spaces above the water distribution lines, permitting the chemicals to penetrate wood surfaces and providing protection against wood rot.

These test blocks were placed on a nutrient agar inoculated with a known wood rot organism. Test blocks A and B had been removed from a tower treated with Nalco steam spray. Test block C had not been treated. Notice extreme accumulation of fungal organisms on untreated block C.




ALTERNATE METHOD OF PORTABLE APPLICATION THROUGH ACCESS PORTS
FAN STACK COVER
MIST ELIMINATOR SECTION
STEAM DISTRIBUTION LINE MOUNTED ABOVE MIST ELIMINATORS
FLEXIBLE HOSE
COOLING WATER RETURN
NALCO CHEMICAL BALL FEEDER
LOW PRESSURE STEAM (Under 150 psi)
TO LOW PRESSURE STEAM

Typical installation of the Nalco steam spray system.

Portable or Permanent?

A number of Nalco-treated cooling towers have been equipped with permanently-installed steam pipes for microbiological control. Others are treated with steam lines and feeding equipment which is put in place for treatment, but moved from tower to tower as needed. Either way, this Nalco technique is providing a degree of economical protection that controls the wood rot hazard, removing it from the list of operators' problems.

Follow-Through Assistance

Your Nalco Representative will be glad to give you details on how your cooling tower non-wetted sections can be protected effectively; and tell you whether your towers need this treatment now. If steam treatment is indicated, he will help set up the necessary equipment, supervise application to assure results, and make periodic checks on the continuing effectiveness of the treatment.

Chemical microbiocides used for steaming are compatible with other *Nalco* chemicals used in cooling towers for stabilization, water-borne microbiological control, and scale and corrosion control. Your Nalco Representative is an expert in this area, too . . . Use his knowledge and experience—backed by the world's largest water treatment service organization—to solve *all* your cooling water treatment problems. Call him today, or write direct, for Prints 264, 265 and 266 which define steam spray application.

NALCO CHEMICAL COMPANY

6227 West 66th Place • Chicago 38, Illinois

Subsidiaries in England, Italy, Mexico, Spain, Venezuela and West Germany
In Canada: Alchem Limited, Burlington, Ontario

Nalco. . . . Serving Industry through Practical Applied Science

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Circle 594 on postcard, page 33

PLANT ENGINEERING EQUIPMENT

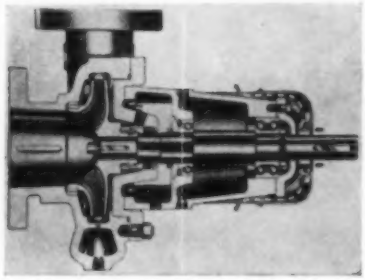
(Begins on page 170)

es about 800 F, pours out over the fire and burns the gases in the chamber; the fuel burns more efficiently, the flame is brighter, and smoke, soot and carbon are reduced—resulting in cleaner tubes and improved capability of boiler to absorb more heat. The boiler "on" cycles become shorter; "off" cycles, longer. Combustion-Aid Corp.

For details, circle 21 on Post Card

PROCESS PUMPS feature parts interchangeability

From two basic pump types, the SMJ and SMJI, up to 72 basic combinations are possible because of the interchangeability feature. By interchanging im-

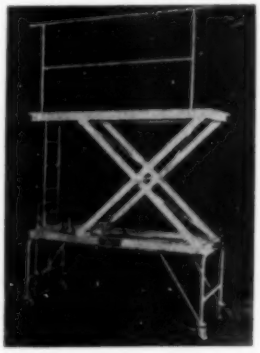


pellers, covers, nozzle arrangements, bearing construction, cooling methods and other components, requirements for almost any service can be met from standard, off-the-shelf parts. Air-cooled bearing housing eliminates need for cooling water supply to bearings in many applications. Model SMJ is designed for high temperature service with top or end suction, and Model SMJI is for lower temperatures. Byron Jackson Pumps, Inc.

For details, circle 22 on Post Card

MOBILE WORK PLATFORM straddles floor obstacles

Adjustable Jr. is a lightweight, straddler type platform of steel construction designed to give access over stationary obstacles up to 44 in. high and 72 in.



wide. Platform is elevated (hand or electric power operation) on a scissoring support frame by means of screw type device. Mechanical pawl type locking device secures platform. Access to non-metallic deck is by telescoping ladder. The Ballymore Co.

For details, circle 23 on Post Card

SULFAMIC ACID CLEANERS for use on scaled equipment

Two sulfamic acid base cleaners are Improved Saf-Acid and Saf-Acid G. The former is a fast-acting, powdered scale remover inhibited to prevent corrosion and foaming. Saf-Acid G is a specialized acid cleaner, reported safe for use in systems containing galvanized metal. E. F. Drew & Co., Inc.

For details, circle 24 on Post Card

RUST PREVENTIVE works on dry or wet surfaces

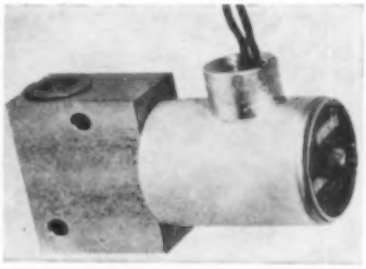
Magnafilm 230 is announced as a low-cost, water compatible, non-flammable rust preventive applicable to dry surfaces or to surfaces wet with water or with cutting oil emulsions. It is reported to furnish excellent indoor protection, eliminate the fire hazard often associated with solvent-cutback rust preventives, remove corrosive fingerprints and protect against fingerprint damage during subsequent handling. The thin, transparent polar film does not interfere with visual inspection or impair legibility of identifying marks.

Longer protection is claimed for Magnafilm 230 because it consists of a known rust preventive modified to form a stable emulsion when mixed with water. When the water evaporates, the rust preventive remains. Normal protection requires seven parts of water to one of Magnafilm 230. The emulsion costs around 45 cents per gallon—enough to dip coat 4400 sq ft of polished steel surface at room temperature. Magnus Chemical Co.

For details, circle 26 on Post Card

SOLENOID VALVES less susceptible to malfunctioning

These two-way solenoid valves for oil pressure to 3000 psi adapt to any type of manifold or subplate. Two types are



available, normally open or closed; both are pilot operated poppet type valves in cartridge form. Standard a-c or d-c solenoids are interchangeable. With only two moving parts, poppet and plunger, susceptibility to malfunction due to contaminated systems is lessened. All valves have free reverse flow in energized or de-energized position. Fluid Power Accessories, Inc.

For details, circle 27 on Post Card

60-AMP ELECTRICAL PLUG designed for maximum safety

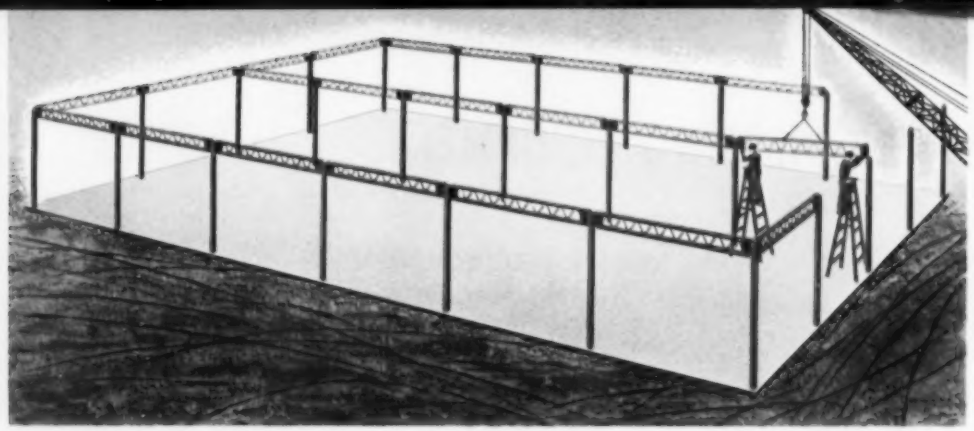
The Arc-Safe, shown with its sleeve removed, has a molded Neoprene rubber body, "safety pin" ground contact and "gator grip" connector-to-cable attachment. Only the polarizing shell is metallic. Arcing during disconnects is

confined within insulated snuffing chambers. The ground contact can be engaged only to that of the mating receptacle. Even if the aluminum polarizing shell is damaged, the connector cannot be properly engaged—the "safety pin" makes contact first and breaks last. The flexible gripping attachment is locked to the cable jacket by a Neoprene sleeve, and grip and tapered sleeve distribute usual bending stresses evenly along the cable, greatly increasing cable life at point of attachment. Bulletin F54 gives full information. Joy Mfg. Co.

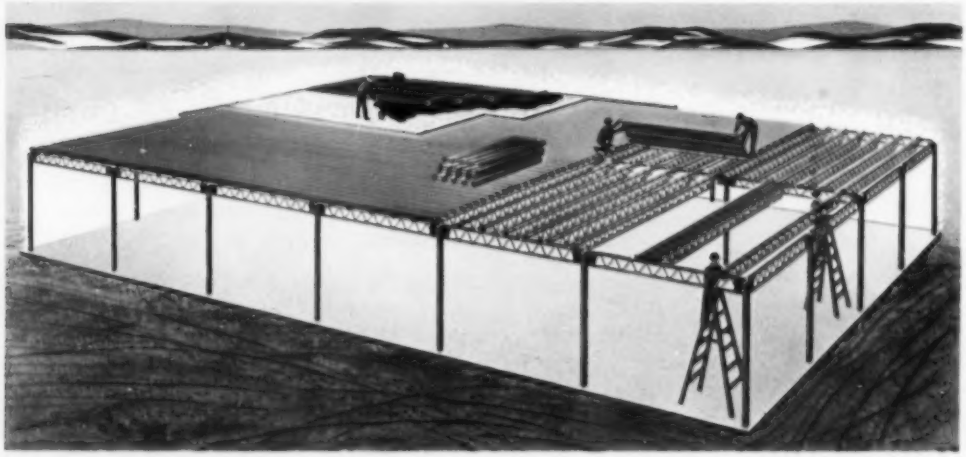
For details, circle 25 on Post Card

ROLLER CONVEYOR reduces accumulation pressure

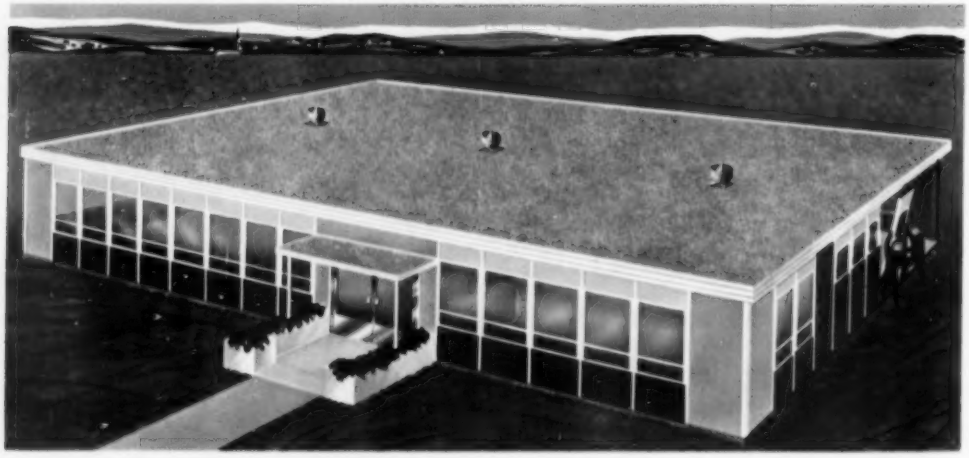
This simple, belt-driven live roller conveyor is designed to handle a broad range of packages of mixed dimensions and weights without buckling the line of accumulated packages or causing erratic conveyor performance. Accu-



A sturdy frame . . .



A simple roof . . .



Slim, colorful panels . . .

AmBridge Modular Construction for distinctive, handsome buildings that go up quickly

This mark tells you a product is made of modern, dependable Steel.

Steel has always meant strength
Architecturally, steel is much more

Today's steel is more strength than your dollar can buy in any other material. It is many extra feet of floor space because steel walls don't have to be thick to be strong. It is days saved in construction time and it's weather-proof—can be handled in any season, anywhere. It is colorful panels and gleaming mullions that help clean themselves. It is skyscrapers and schools, churches and commercial buildings because it is the architect's most versatile material for design.

Take USS AmBridge Modular Construction. The light, sturdy steel frame can be erected by a few men in a few days. Add a few more days for the simple roof, complete with supporting joists that accommodate and conceal piping and ductwork. Add a splash of color with tough, space-saving steel wall panels—and get walls with fine thermal and acoustical values in the bargain. They are available in 81 different colors and five finishes.

USS AmBridge Modular Construction permits distinctive architectural design, long-term economy and satisfaction. Have you ever put all the qualities of steel to work for you? Write for our new booklet for complete information.

USS and AmBridge are registered trademarks

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American Bridge Division of United States Steel

PLANT ENGINEERING EQUIPMENT

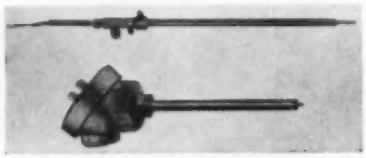
(Begins on page 170)

mulation pressure on commodities is reduced to a mere 3½ per cent of commodity weight. Requiring only 50 per cent of horsepower normally used for equivalent capacity conveyors, it is available in widths from 10½ to 38½ in. between frames and costs no more than conventional belt-driven conveyors. Standard Conveyor Co.

For details, circle 28 on Post Card

TEMPERATURE SENSORS for use up to 4000 F

These thermocouple type sensors, cooled and non-cooled, measure liquid, solid and gasous temperatures. Some are usable in oxidizing atmosphere up to 4000 F and intermittently higher. Their applicability is accomplished by



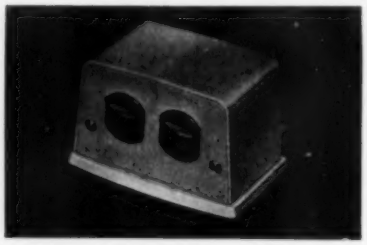
use of refractory metals . . . tantalum and molybdenum with CR oxidation resistant coatings. Insulation is magnesia and beryllia and thermocouple wires are iridium, tungsten, rhenium and alloys of these. The probes are designed for measuring exhaust gas in an afterburner, molten glass, combustion processes, etc. Technical data in Product Information Report 8.1. Aero Research Instrument Co., Inc.

For details, circle 29 on Post Card

More information on any of this equipment can be yours without cost or obligation. Just circle the item numbers on the Reader service Cards provided on pages 33-34.

FLOOR BOX FITTINGS in streamlined modern design

Ultra - modern in silhouette, Lo - Boy Service Fittings are less than 3 in. high when installed flush to the floor. The housing, made of three aluminum die-castings (top shell, base and front plate) is internally reinforced for greater mechanical strength. After wiring connections are made, the assembly involves only sliding the top shell into grooved base and fastening



front plate with two screws. A 1¼-in. dia nipple makes wiring easy. Fittings are available with grounded duplex receptacles on one side only, or on both sides; they are for three-wire, 15-amp, 125-v service. Frank Adam Electric Co.

For details, circle 30 on Post Card

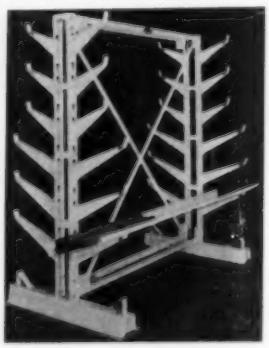
TRANSISTORIZED RELAY has varied machinery use

This transistorized sensitive relay has high impedance input for stop motion, inspection, sorting and positioning of machinery. Its big advantage is that it needs no time for warm-up. Sensitivity is also a built-in feature. The low-powered relay can be applied to textile machinery, machine tools and general machinery and may also be used in conjunction with photocells, thermistors and liquid level probes. Rated at 10 amp, 300 v, a-c, it has double - pole, double - throw contacts. General Electric Co.

For details, circle 31 on Post Card

CANTILEVER RACK with flexible, adjustable arms

Columns of the Adjustable Arm Cantilever Rack are of heavy structural steel welded to formed plate bases, joined by

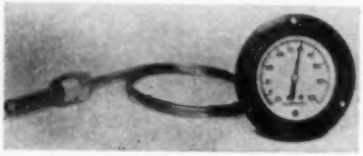


cross and X-bracing to set up stable and rigid units. Keyway slots provide adjustable spacing for arms which button on in minutes with no bolts or nuts required. Units come in single or double arm construction with 12- or 16-in. arms. Pans to span two arms and accommodate short length pipe, rod, small parts, etc. are available. Standard seven-tier, double-arm unit (1000-lb. capacity each arm, total capacity 28,000 lb on 14 tiers) costs about $155. Jarke Mfg. Co.

For details, circle 32 on Post Card

THERMOMETERS are vapor tension-actuated units

Series 8000 thermometers, vapor tension-actuated, can serve as temperature indicators for use with such equipment as ovens, vats, air ducts and temperature-operated valves. They are center

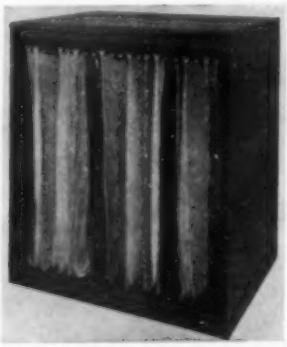


back connected and normally panel mounted, but may be custom designed. Dial sizes are 2, 2½, 3½ with markings unevenly graduated for nonlinear relationship of temperature and pressure. Drawn metal case, with bourdon-tube of non-ferrous metal, houses the corrosion-resistant movements. Thermometers are available optionally with company's Zero Set which requires only a screw driver for recalibrating. U. S. Gauge Div., American Machine & Metals, Inc.

For details, circle 33 on Post Card

FILING CABINET protects drawings, maps, blueprints

Stikfile Model OC-2224 is an open-type steel filing cabinet with ceiling mounted traverse tracks and binders



for hanging drawings, blueprints, and maps. Binders slide in and out on tracks and hold from 1 to 75 prints each; total capacity 1650 prints. A label strip extends across front of cabinet above the track for easy in-

New from Du Pont: Protective Finishes Formulated Specifically to Combat Severe Corrosive Conditions

(T.M.)

IMLAR

Vinylmastic Coatings and Vinyl Enamels

Du Pont announces a new line of chemical-resistant coatings to help you hold down spiralling maintenance costs by providing dependable, long-term protection under corrosive conditions that cause ordinary maintenance paints to fail rapidly.

Ideal for Severe Acid Conditions

IMLAR Vinylmastic Coatings and Vinyl Enamels possess extraordinary resistance to spillage, fumes and vapors from highly corrosive acids and alkalies—including sulfuric and nitric acid, sodium chloride, ammonia and lime. They also withstand persistent condensate, water immersion and salt spray, have excellent resistance to radiation decontaminating solutions, are unaffected by surface temperatures up to 150° F.

For Indoor or Outdoor Applications

Ready-mixed IMLAR coatings are recommended for field or maintenance painting of any steel or concrete surface subject to highly corrosive conditions. They can be used indoors as well as out, on buildings, structural steel, heavy machinery, bins, hoppers, tank or vat interiors and exteriors. Applied in three stages—primer, intermediate and topcoat—they dry quickly to a thick, hard, semi-gloss finish with excellent cohesion and flexibility, superior distensibility and abrasion resistance.

Relatively non-toxic, IMLAR coatings are easy to apply with conventional spraying equipment. Proper surface preparation (preferably sandblasting) is a must. Topcoats come in red or gray as well as black and white. Typical industrial applications for IMLAR include bleacheries, paper mills, chemical and petroleum plants.

For areas with severe alkali conditions, use new Du Pont CORLAR(T.M.) Epoxy Chemical-Resistant Finishes. They offer excellent resistance to chemical fumes, spills and moisture.

For recommendations concerning your own specific corrosion problems, get the expert advice of your local Du Pont Technical Representative. To reach him, call your nearest Du Pont District Sales Office, listed in your phone book. For more detailed information about these new finishes, clip and mail the coupon below.

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IMLAR (T.M.)
Chemical-Resistant Coatings

Better Things for Better Living . . . *through Chemistry*

Circle 596 on postcard, page 33

PLANT ENGINEERING EQUIPMENT

(Begins on page 170)

dexing. Top of cabinet is at convenient height for reference and working space. Dancer Stikfile Co.

For details, circle 34 on Post Card

PLASTIC TUBING takes high pressures, temperatures

Impolene can be used at operating temperatures to 300 F and working pressures to 450 psi, according to manufacturer of this stabilized polypropylene tubing. It is reputed to have longer usable life than other thermoplastic tubing because there is no gradual change in physical properties under adverse conditions. Tubing can be repeatedly steam sterilized, resists corrosion and acids, has nearly zero water absorption and low mineral and vegetable oil absorption. Product Report 301 gives information. Imperial-Eastman Corp.

For details, circle 35 on Post Card

DETACHABLE FITTING for high pressure hose

Iron Mike offers low initial cost plus reusability. For use with company's 1509 Hose, a multiple wire braid, high-pressure type, these fittings come in 10 end fitting styles, include male pipe, JIC swivel, JIC male flare, SAE straight thread, JIC swivel elbows (both 45 and 90 deg), split flange fittings (straight, 45 and 90 deg). Basically, the Iron Mike has three

components: a tapered steel socket, (shown at right) which is pushed over segments during assembly to form a rugged compression fitting that won't blow off; two aluminum segments (center) which grip hose reinforcement, and mate with nipple assembly; and a steel nipple (without threads) which fits into hose. The variable component is the nipple, which is supplied in 10 end styles. These fittings are designed for hose sizes from ¼ to 2 in. Bulletin 651 gives further information on these hose fittings. Aeroquip Corp.

For details, circle 36 on Post Card

PREFAB WOOD SHELVING installs with screwdriver

Timber-Shelves combine the advantages of wood with the strength of steel. A complete shelving system can

be installed, extended or dismantled by one man using only a screwdriver in a few minutes. Timber-Shelves can be installed as individual units, continuous runs, island or back to back. Shelves are ¾ in. thick, reinforced against warping by steel angles which are integral parts of each shelf end. Steel channel uprights are punched every 1½ in. to permit a wide range of shelf positions. Timber-Shelf, Inc.

For details, circle 37 on Post Card

INDUCTION MOTORS with superior starting features

Three outstanding features of Schorch motors are: improved starting operation at temperatures corresponding to Class B insulation and impregnation of stator windings for resistance to corrosion and water. Open drip-proof motors range from ½ to 200 hp, totally enclosed types from ½ to 100 hp, both built to rerated NEMA frames. Georg von Opel Corp.

For details, circle 38 on Post Card

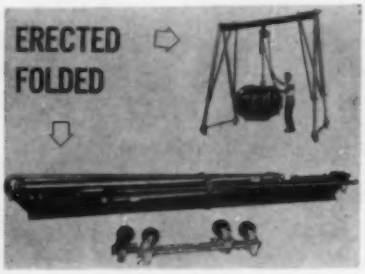
FLEXIBLE-ARM LAMP easily moved where needed

Multi-Lamp's original feature is a snap-on "button" mounting bracket for attachment to desired supports. With additional buttons installed throughout working area, the lamp may be snapped off and moved where needed. Lamp has heavy-duty flexible neck covered with polyvinyl, impact- and heat-resistant phenolic shade, spun-aluminum reflector, and nylon and ball bearing fittings. Available in colors and black, right angle or straight base, and neck lengths ranging from 12 to 24 in. Moffatt Products, Inc.

For details, circle 39 on Post Card

4-TON GANTRY CRANE folds up for storage

Magic-Pole Universal Gantry can be dismantled by removing its caster frames, closing its telescoping legs and folding them against the I-beam. When disassembled, there are only three basic sections. The crane may also be lowered and narrowed for rolling under fire doors, into elevators, etc. At the job it can be raised to maximum height



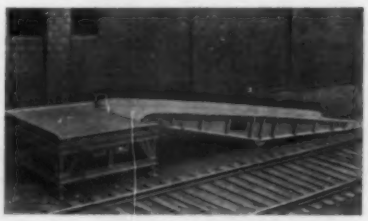
and its casters spread wide for stability. Telescoping legs adjust separately, allowing setups on different levels. A self-traveling I-beam is also provided for off-center loads. Five models are available with steel or aluminum alloy I-beams in spans to 30 ft, heights to 17 ft, capacity to 4 tons. B. E. Wallace Products Corp.

For details, circle 40 on Post Card

(Continued on page 184)

PORTABLE PLATFORM-RAMP for limited-space areas

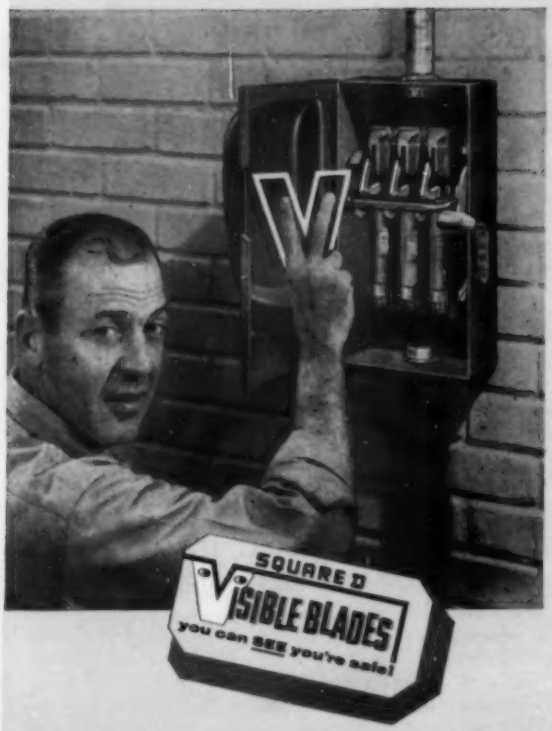
The Magliner Ramp is a portable magnesium platform and ramp combination for use where parallel rail tracks, adjacent buildings or other obstructions prevent normal right-angle approach to carriers. It can be positioned directly alongside railcars, trucks and trailers, with platform opposite side-door opening. Ramp has open grating surface with serrated tracks for all-weather traction. It hydraulically ele-



vates to desired height, has safety chains to lock it to platform. Capacities range to 20,000 lb. Magline Inc.

For details, circle 41 on Post Card

FOR SAFETY YOU CAN SEE REMEMBER THE "V" FOR VISIBLE BLADES!



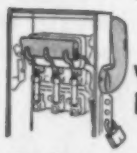
• The men who pull the switches will tell you what can happen when a switch, *believed* to be open —*isn't*. A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on Visible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because *Square D switches have never been out of first place in more than 50 years!*

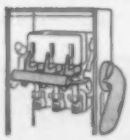
They cost no more... why settle for less?

Square D Company, Mercer Road, Lexington, Kentucky

Extra Safety with Square D's Handle Design



WHEN IT'S UP
IT'S ON!



WHEN IT'S DOWN
IT'S OFF!

Handle is integral part of switch, not cover. When door is opened, handle remains attached to switch. Eliminates hazard of false handle indication or defeat of padlock provision. When it's padlocked, it's locked!

SQUARE D COMPANY

wherever electricity is distributed and controlled

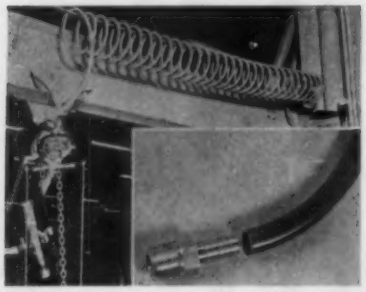
Circle 597 on postcard, page 33

PLANT ENGINEERING EQUIPMENT

(Begins on page 170)

SELF-STORING HOSE has extra thick walls

Synflex Heavy Duty Self-Storing Air Hose is for use where plant air pressure is greater than average or where

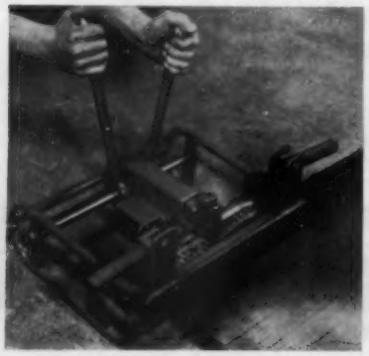


mechanical stresses are extreme. Helically coiled like a spring, it extends to needed working length and, after use, retracts into storage space about 1/30th of its maximum working length. Minimum working pressure with 4-to-1 safety factor is 250 psi at 75 F. Two types of fittings are standard: barbed shank and swivel barbed shank. Hose is blue in color, comes in four sizes from 3/16 to 3/8 in. ID, lengths through 100 ft. Synflex Products Div., Samuel Moore & Co.

For details, circle 42 on Post Card

SPLICE MAKER adapts to all conveyor belts

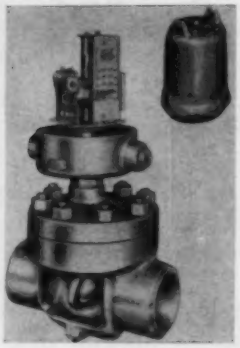
The Hayden Zipper, a portable, one-man splice maker for conveyor belts, is adaptable to all belt thicknesses, widths and types. It can be used in confined places. The belt fastener has a transport height of 9¼ in. and a vertical working height with operating levers extended of only 16 in. A companion product is a long-reach hook which grips the belt carcass far back from the edge of the splice. Improved hook construction, combined with the Zipper's 7-mm hook spacing, is said to afford longer wearing splices. Four hook types used with the Zipper cover the range of belt thicknesses and pulley diameters without adjusting machine. Scandura, Inc.



For details, circle 43 on Post Card

SWING-CHECK VALVE doubles in flow control

Model FCV is a full-flow, swing-check valve combining advantages of a check valve and a flow control, for practically any liquid at any pressure or temperature, in one compact package. Valve



disc is magnetically coupled to switch mechanism, having mercury-to-mercury switch contacts. Pneumatic pilot mechanism can be substituted for standard electric switch mechanism as an optional feature. Field adjustable unit is designed to remotely signal flow or no-flow through the valve; and/or provide an interlock safety control in start-up or shut-down, flow or no-flow. It can also indicate position of valve at any point from full closed to full open. Magnetrol, Inc.

For details, circle 44 on Post Card

ANTI-RUST PAINT can be applied over damp surfaces

Rustrem-MS combines a heavy bituminous alkyd base with a penetrating vehicle containing dialkyl dimethyl ammonium chloride. The latter is reported to "cut" through moisture to surface metal. Rustrem-MS is suggested for wet weather use or in locations where it is impossible to thoroughly dry metal surfaces. It can be brushed, sprayed or rolled on, and within 4 hr after application it forms a shiny, black elastic coating. It resists dampness, mild industrial acids and fumes, grease, oil, extreme temperature changes and sun drying. It is also said to retard corrosive effects of salt water and salt air. Speco, Inc.

For details, circle 45 on Post Card

It's easy to obtain product data with the postage-free Reader Service Card provided on pages 33-34. Use them for information on advertised products, too. Just circle the key number at bottom of the ad.

FHP SPEED REDUCER can be shaft- or flange-mounted

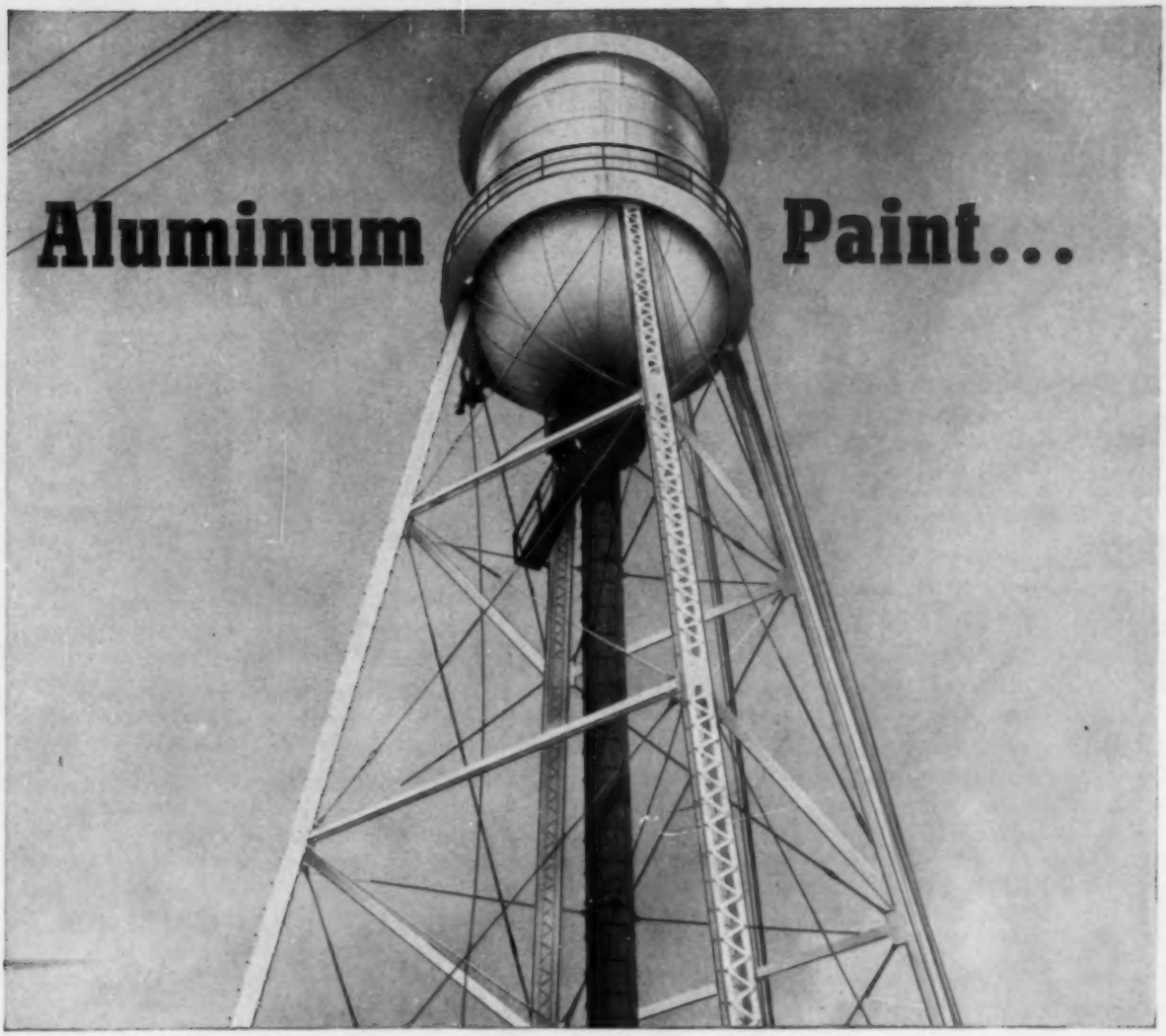
This fractional horsepower speed reducer, TD025, has a gear ratio of 25 to 1 and will transmit up to 0.95 hp at maximum recommended output speed of 85 rpm. A predetermined combination of reducer and V-belt drive can provide any speed ratio up to 175 to 1. As shaft-mounted reducer

it is equipped with torque arm for simple adjustment of V-belt drive center distance. As flange-mounted reducer it can be bolted directly to driven machine or supporting structure. Standard reducers are bored for 1¼ in. shafts; bushings can be had for smaller shafts. Dodge Mfg. Corp.

For details, circle 46 on Post Card

HYDRAULIC HAND PUMP, two speed, high pressure

OTC Dualmaster, Y-29 Series, not only handles high force, high pressure requirements to 10,000 psi, but delivers high volume at low pressure (7.35 cu in. per stroke from 0 to 200 psi) to quickly move the cylinder piston to and from the work. It automatically changes to the high pressure stage when a load is encountered, delivering 0.294 cu in. per stroke from 200 to 10,000 psi. Common cover plate, to which pump and valving are mounted, permits use with other than standard OTC reservoir. A mounting pad on



...a bright spot in maintenance costs

The Finest Paints Made with Aluminum are made with REYNOLDS ALUMINUM PIGMENT

Highly reflective, long-lasting aluminum paint prevents rust... resists corrosion... keeps costs down

Paint made with Reynolds Aluminum pigment protects surfaces by forming a shield of pure aluminum. Weathering extremely well, this shield guards under-surfaces against rust, rot and corrosion. It's your best investment in low-cost preventative maintenance. And remember: aluminum reflects radiant heat to keep building and tank interiors up to 14° cooler, and to protect volatiles from evaporation. *Reynolds Metals Company, P.O. Box 2346-PL, Richmond 18, Virginia.*

REYNOLDS ALUMINUM

Watch Reynolds TV show "Harrigan & Son", Fridays—ABC-TV

Circle 598 on postcard, page 33

PLANT ENGINEERING EQUIPMENT

(Begins on page 170)

cover plate accepts a two-way valve for controlling single-acting cylinders or a four-way valve for controlling double-action cylinders. The pump weighs only 34 lb, is 26½ in. long, has 2-gal reservoir capacity. Owatonna Tool Co.

For details, circle 47 on Post Card

SUSPENSION SYSTEM for electrical cable service

Line-Flex Cable Suspension System offers flexibility in one plane or non-sag rigidity in the opposing plane and needs no special equipment or tools to install. It is for use in non-supported rigid lengths up to 14 ft or catenary applications involving lengths of 400 ft or more. Line-Flex may be

placed in tension without distortion or damage, according to manufacturer. In obstacle-studded installations, it can be bent along its flexible plane using radii much smaller than allowed equivalent standard conduit, and several hundred feet of cable may be pulled through as many as three 90-deg angles by hand. Installation costs are claimed less than those of other methods, and the Line-Flex may be dismantled for re-use. Line-Flex dissipates heat by radiation and convection. Single cable lengths may be used at free-air rated capacity, and in multiples at reduced ratings. Line-Flex comes in zinc coated or stainless steel, in several diameters. Perfect-Line Mfg. Corp.

For details, circle 48 on Post Card

LIQUID FLOOR COATING brushes on, dries overnight

Chemi-Cote brushes on concrete floors like paint, but dries within hours to form a uniform surface that resists abrasive action and prevents dusting. Claimed four times tougher than concrete itself, Chemi-Cote is a catalyst hardened co-polymer. It fills and levels small holes, cracks and chips. It can be used on any clean, dry, basically sound floor—new or existing—and adheres without bonding or slush coat. A two-ingredient product, it is mixed, poured on the floor and brushed smooth. One application levels out to form a 1/32-in. thick plate tough enough to stand heavy wheel trucking. Chemi-Cote comes in red, green and two shades of gray. The Garland Co.

For details, circle 49 on Post Card

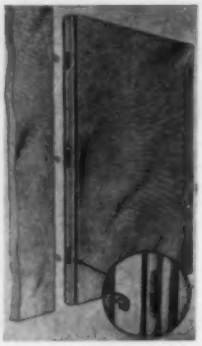
PIPE WRENCHES, big and small in size

These malleable pipe wrenches feature drop-forged calibrated hookjaws, double-action springs and easy adjustment. They come in a range of nine sizes from 6 to 48 in. with opening sizes from ⅛ in. to 6 in. Armstrong Bros. Tool Co.

For details, circle 50 on Post Card

THIN PANEL reduces noise like a 4-in. one

Series 10 Noiseguard Panel, of 1-in. overall thickness, consists of a fire-retardant, self-supporting acoustical core sandwiched to sheet metal. While thinner and lighter than most construction for noise abatement, this panel



provides superior sound attenuation with particular emphasis on that in the low frequency spectrum. Several innovations are responsible: First is an acoustical core with sufficient structural integrity to eliminate conventional use of stiffeners as "sound bridges" or heavy weight steel casings. Second, sheet metal surfaces are rendered acoustically "dead" by a visco-elastic sound and vibration damping coating. Finally, latch-locks, operated by a key, join adjacent panels together with enough force to provide a positive seal and prevent noise leakage. This fastening method also simplifies and speeds assembling and demounting of enclosures without loss of acoustical properties. Bulletin K16D gives data. The Korfund Co., Inc.

For details, circle 51 on Post Card

PUSH BUTTON does heavy duty punch press service

This push button for use with punch press machines (CR2940NP) can have lock and key as added protection. Palm operators come in chrome or plastics

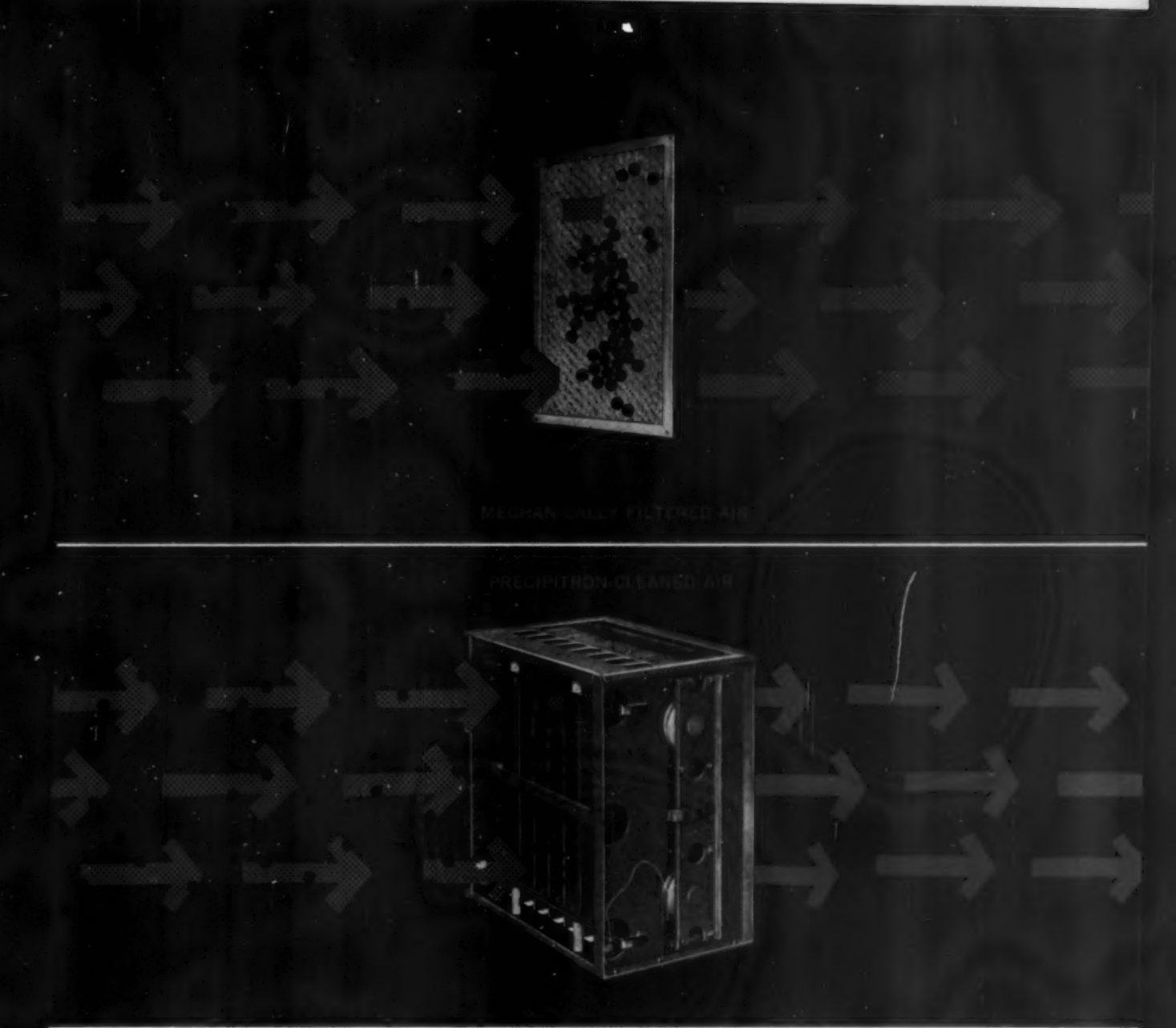
in five colors. Single circuit blocks can be replaced or changed from normally open to closed. The unit fits any standard FS or FD type box or can be mounted on a flat surface. Terminals will accept up to No. 12 wire. General Electric Co.

For details, circle 52 on Post Card

LIQUID LEVEL ALARM uses signal light and bell

When liquid reaches predetermined level, this alarm turns on a signal light and sounds a horn or bell. A silencer button turns off the sound, just the light stays on until liquid level is

changed in desired direction. Alarms are used with a King-Gage or other air-actuated purge-type gaging system, and can be used with any liquid in any storage or processing vessel that is vented to atmosphere. Models are available for response at high level, low level, or both. High-level and



Electronic air cleaning traps the expensive dirt

Minute particles of dust, dirt, smoke and bacteria...of less than 1 micron in size...pass right through mechanical filters. This is the dirtiest airborne dirt. The most expensive dirt. It soils walls, merchandise, lighting fixtures. Wears out moving parts. Shorts out motor windings. Contaminates foods, drugs, paints, chemicals. Causes malfunctions in electronic and precision equipment. Ordinary mechanical filters cannot trap this dirt.

But with PRECIPITRON® electronic air cleaners you trap all dirt sizes ...including the damaging minute particles as small as 1/100 micron. With PRECIPITRON you can cut down housekeeping expense, product rejects, wear on equipment, and contamination...by trapping the expensive dirt that filters cannot catch. Yet PRECIPITRON is less expensive to own and maintain.

Talk to your consulting engineer. Or call in Sturtevant application engineers. They're experts in handling air...whether you want to move it, heat, cool or clean it.

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Hyde Park, Boston 36, Mass.

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J-80719

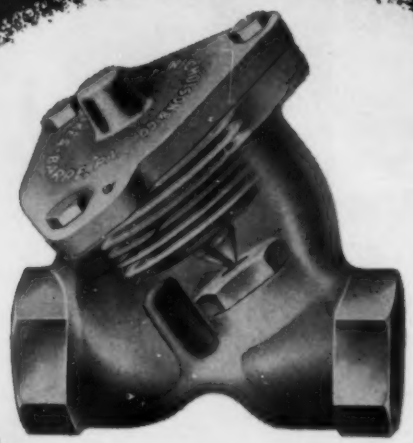
®—WESTINGHOUSE TRADEMARK

You can be sure...if it's **Westinghouse**

Circle 599 on postcard, page 33

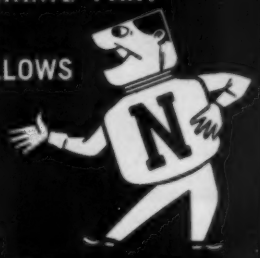
A NEW DEVELOPMENT

FOR STEAM-SAVING EFFICIENCY

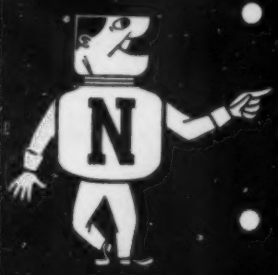


Nicholson Thermostatic Steam Trap Model N-150

- ALL STEEL CONSTRUCTION
- JUST ONE WORKING PART
- RUGGED MONEL BELLOWS



- NEW BAFFLE* . . . deflects steam upward and away from the orifice to surround the bellows



- FREEZE PROOF WHEN INSTALLED VERTICALLY
- CAN BE TESTED AND INSPECTED WITHOUT BREAKING PIPE CONNECTIONS
- COMPACT, LIGHTWEIGHT, EASY TO INSTALL

- FOR TRACER LINES also Plating Tanks Platen Presses • Unit Heaters • Sterilizers and various types of Cooking and Laundry Equipment. N-150 Traps can also be used as air vents for Receivers, Water Heaters, Mechanical Traps, etc.

- W. H. NICHOLSON AND CO.
12 Oregon St., Wilkes-Barre, Pa.

* Patent applied for

Circle 652 on postcard, page 33

PLANT ENGINEERING EQUIPMENT

(Begins on page 170)

low-level alarms have 110-v signal lights, while high-and-low level alarms can be furnished with 110-v or 6-8-v lights. Bulletin EX-700 gives data. King Engineering Corp.

For details, circle 53 on Post Card

V-S LINK BELTING is adjustable to any length

Variable-speed belting in link form for easy adjustment to required length is available in single (shown) or twin link types, widths from 7/8 to 4 in.

Adjusta-Link fits all V-to-V drives, is interchangeable with endless molded and wood block belts, and sold by the foot. It is heat- and oil-resistant, is installed with pliers and hook tool. Lovejoy Flexible Coupling Co.

For details, circle 54 on Post Card

GAS-FIRED BOILERS have neat, "built in" look

Steam and hot water heating boilers in the 48 Series have compact cabinets with baked white enamel jackets, 30 3/4 in. high. Boiler sections and one-piece burners are corrosion-resistant cast iron. Constant water temperature is

COSTS LESS TO BUY AND ERECT!

New one-piece shelf clips lower shelving costs—can be installed without tools. Made of heavy gauge steel, the clips are strong enough to support heavy loads.

Up to 50% saving on erecting costs. This standard 8-shelf unit was erected by 2 men in less than 10 minutes, thanks to the new one-piece shelf clips.

GIVES GREATER ADJUSTABILITY!

New clip-type shelves go in and out without tilting. Shelves need not be unloaded to be repositioned. What's more, no tools are required to make shelf adjustments.

Shelves are adjustable on 1½" centers. This feature, plus the beaded front post, eliminates wasted space—gives more useable storage capacity in less floor space.

HALLOWELL

CLIP TYPE *ERECTOMATIC*® SHELVING

CHECK THESE OTHER ADVANTAGES:

- Interchangeable with regular Erectomatic shelves and shelf supports.
- New clip fits flat against post—does not steal storage space.
- New, stronger shelves. Corners are lapped and spot welded.
- Available on the most liberal lease plan in the industry.

COLUMBIA-HALLOWELL Division SPS
JENKINTOWN 26, PA.•SANTA ANA, CALIFORNIA

where reliability replaces probability

MAIL COUPON FOR FREE CATALOG

COLUMBIA-HALLOWELL Division SPS
Jenkintown 26, Pa.

Please send me catalog on new Hallowell Clip-Type Erectomatic Shelving

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Circle 600 on postcard, page 33

PLANT ENGINEERING EQUIPMENT

(Begins on page 170)

maintained by silent operating controls. The units have high-capacity circulating pump, fiber glass insulation. With tankless water heater, the line includes seven AGA input ratings from 120,000 to 300,000 Btu per hour. Without heater, they are available in lower AGA ratings to 60,000. Janitrol Div., Midland-Ross Corp.

For details, circle 55 on Post Card

SQUARE PANEL FANS install fast, run quietly

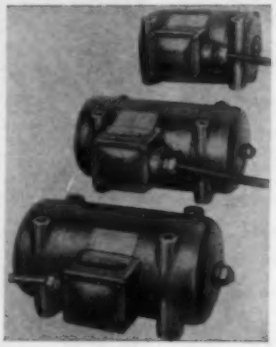
This line of fans includes three models. Direct connected, Type PQ, in six sizes with fan diameters from 12 to 36 in., delivers 1235 to 10,860 cfm under free air conditions. It is suggested for offices and other area where

extremely quiet operation is desired. Also direct connected, Type PD (shown) comes in five sizes from 24 to 48 in. and delivers 4700 to 32,200 cfm. It is suitable for exhausting smoke, dust and fumes, or as circulators and man coolers. The belt-driven slow speed Type PB, sizes 42, 48 and 60 in., 14,320 to 52,700 cfm, is for general applications requiring greater air movement at relatively low noise levels. All of these square panel fans have airfoil section propeller blades of an aluminum-magnesium alloy. Each fan is normally powered by manufacturer's totally-enclosed All-Weather Motor. Propellair Div., Robbins & Meyers, Inc.

For details, circle 56 on Post Card

EXTERNAL VIBRATORS for heavy-duty applications

These electric vibrators feature a considerably shortened shaft between bearings to reduce bearing strain and minimize bend in the shaft at high speeds. Available in three compact sizes (one slightly larger than a football) with impacts from 500 to 1400 lb, the vibrators are designed to fit bins, chutes,



screens and come with holders for attachment to hopper bottom railroad freight cars. They are claimed particularly effective for unloading cement, gypsum, coal, sand and similar bulk materials. High centrifugal force motion build-up delivers a power/weight ratio of 20 to 1. Tremix Co., Inc.

For details, circle 57 on Post Card

NIGHT LAMP burns 21 months without relamping

Fluorescent Nite Light is reported to last up to six times as long as its incandescent counterpart in normal 10-hr daily use — to light up to 21 months before the standard 4-w, 6-in. fluorescent lamp needs to be replaced. The unit has louvered face and is recessed into the wall. Outside frame dimensions are 8¼ by 6-7/16 in.; the recessed box is slightly smaller and 3 in. deep. Installation can be made to wood through mounting holes in the box. Brackets are included for attachment to metal lath, and the unit can be mounted in concrete. It's wired for 120-v service, easy to re-lamp. Day-Brite Lighting, Inc.

For details, circle 58 on Post Card

G-B SNAP*ON DISTRIBUTORS

AKRON, Ohio, The Asbestos Supply Co.
ALBANY, Ga., Industry Insulation Co.
ALBANY, N. Y., Hudson Valley Asbestos Corp.
ALBUQUERQUE, N. M., Mt. States Insulation Co.
AMARILLO, Tex., McDonald Engineering & Insulating Co
Morrison Supply Co.
ANDERSON, S. C., Building Material & Equipment Co.
ATLANTA, Ga., Reynolds Aluminum Supply Co.
Parker-Rico Insulation Co.
AUGUSTA, Ga., The Noland Co.
AUSTIN, Tex., Cinbar Engineering Co.
BALTIMORE, Md., Leroy Insulation Co.
BANGOR, Me., Eastern Glass Co.
BATON ROUGE, La., Eagle Asbestos & Packing Co.
BEAUMONT, Tex., Coburn Supply Co., Inc.
Solar Supply Co.
BILLINGS, Mont., Big Horn Supply, Inc.
BIRMINGHAM, Ala., Reynolds Aluminum Supply Co.
Shook & Fletcher Supply Co.
BORGER, Tex., Western Chemical & Supply Co.
BOSTON, Mass., Homans-Kohler, Inc.
BRIDGEPORT, Conn., Robert A. Keasbey Co., Inc.
BRUNSWICK, Ga., Baker Bros., Inc.
BUFFALO, N. Y., Industrial Insulation Sales, Inc.
BURLINGTON, Vt., Pipe Insulators, Inc.
CHAMPAIGN, Ill., The Lewie-David Co.
CHARLESTON, S. C., Baker Bros., Inc.
CHARLESTON, W. Va., Asbestos & Insulating Co.
CHARLOTTE, N. C., D & B Insulation Co.
CHATTANOOGA, Tenn., The Noland Co.
CHICAGO, Ill., E. C. Carlson Co.
Culberg Asbestos & Cork Co.
CHRISTOPHER, Ill., Hoe Supply Co.
CLEVELAND, Ohio, Ohio Asbestos & Insulation Co.
COLUMBUS, Ohio, Santeler Brothers; Culberg of Ohio
CORPUS CHRISTI, Tex., Precision Insulation Co.
DALLAS, Tex., Acme Insulation & Supply Co.
Electrical Supply Corp.
Payne-Ladewig, Inc.
DAVENPORT, Iowa, Republic Electric Co.
DAYTONA BEACH, Fla., B & F Insulation Co.
DECATUR, Ill., The Lewie-David Co.
DENVER, Colo., Plateau Supply Co.
DES MOINES, Iowa, Iowa Asbestos Company, Inc.
DETROIT, Mich., The Walter Rankin Co.
EL PASO, Tex., Insulation Specialties Co.
M&M Refrigeration & Sply. Co.
ERIE, Pa., Loco-McMullen Co.
EVANSVILLE, Ind., Geo. Koch Sons, Inc.
FALCONER, N. Y., Loco Roofing
FT. SMITH, Ark., Ball Distributing & Engineering Co.
FT. WAYNE, Ind., M. H. Hilt, Inc.
FT. WORTH, Tex., Bracken Co.
GAINESVILLE, Fla., Baker Bros., Inc.
GRAND RAPIDS, Mich., M. S. Knoe Co.
GREENSBORO, N. C., Starr Davis Co., Inc.
GULFPORT, Miss., Paine Supply Co.
HONOLULU, Hawaii, Parker-Fallis Insulation Co., Inc.
HOUSTON, Tex., Precision Insulation Co.
INDIANAPOLIS, Ind., Lyon Lumber & Supply Co.
IRON MOUNTAIN, Mich., Champion, Inc.
JACKSON, Miss., Paine Refrigeration Supply Co.
JACKSONVILLE, Fla., Baker Bros., Inc.
Eckles Distributors, Inc.
Forber Sheet Metal Works
Reynolds Aluminum Supply Co.
JOPLIN, Mo., Joplin Cement Co.
KANSAS CITY, Mo., Central Supply Co.
Insulation & Acoustical Specialties, Inc.
Kelley Asbestos Prod.
KEWANEE, Ill., Mechanical Insulation Co., Inc.
KINGSPORT, Tenn., Willis Supply Kingsport, Inc.
KNOXVILLE, Tenn., Willis Supply Co.
LAKE CHARLES, La., Coburn Supply Co., Inc.
Solar Supply Co.
LOS ANGELES, Calif., Accurate Insulation Co., Inc.
Western Fibrous Glass Products Co.
LOUISVILLE, Ky., General Insulation & Roofing Co.
LUBBOCK, Tex., Mechanical Equipment
Morrison Supply Co.
MACON, Ga., Industry Insulation Co.
MARIETTA, Ohio, Asbestos & Insulating Co.
MEMPHIS, Tenn., Gibbons Supply Co.
John A. Denie's Sons Co.
MIAMI, Fla., Reynolds Aluminum Supply Co.
Southern Metal Products Co.
Industrial Insulators, Inc.
MILFORD, Ohio, Insulation Contr. & Sup. Co.
MILWAUKEE, Wisc., F. B. Dengel Co.
MINNEAPOLIS, Minn., Asbestos Products, Inc.
MOBILE, Ala., Shook & Fletcher Insulation
MONTGOMERY, Ala., Shook & Fletcher Insulation
MOORHEAD, Minn., Fargo-Moorhead Insulation Co.
NASHVILLE, Tenn., Reynolds Aluminum Supply Co.
NEWARK, N. J., Eastern Steam Specialty Co.
Robert A. Keasbey Co., Inc.
NEW ORLEANS, La., Eagle Asbestos & Packing Co.
NEW YORK, N. Y., Eastern Steam Specialty Co.
Robert A. Keasbey Co., Inc.
ODESSA, Tex., Western Chemical & Supply Co.
Morrison Supply Co.
OKLA. CITY, Okla., Ball Distributing & Engineering Co.
OMAHA, Nebr., Cardinal Supply & Mfg. Co.
ORANGE, Conn., Insulation Supply Co.
ORLANDO, Fla., Baker Bros., Inc.
PADUCAH, Ky., Triangle Insulation Co.
PASCAGOULA, Miss., Shook & Fletcher Insulation
PHILADELPHIA, Pa., John F. Scanlan, Inc.
PHOENIX, Ariz., Williams Insulation Co.
PITTSBURGH, Pa., Dravo Corp., Keystone Div.
PORT ARTHUR, Tex., Coburn Supply Co., Inc.
PORTLAND, Me., Eastern Glass Co., Inc.
PORTLAND, Ore., Western Fibrous Glass Products Co.
RALEIGH, N. C., Reynolds Aluminum Supply Co.
RAPID CITY, S. D., Robbins & Stearns Wholesale
RED BANK, N. J., Altex Pipe & Supply Co.
RICHMOND, Va., Reynolds Aluminum Supply Co.
ROANOKE, Va., C. E. Thurston Co.
ROCKFORD, Ill., Mott Brothers Co.
SACRAMENTO, Calif., The Brookman Co.
SALT LAKE CITY, Utah, Bullough Asbestos Sup. Co.
SAN ANTONIO, Tex., San Antonio Machine & Supply Co.
SAN DIEGO, Calif., Western Fibrous Glass Products Co.
SAN FRANCISCO, Calif., Western Fibrous Glass Prod. Co.
The Brookman Co.
SAVANNAH, Ga., Baker Bros., Inc.; The Brower Co.
Reynolds Aluminum Supply Co.
SEATTLE, Wash., Western Fibrous Glass Products Co.
SHREVEPORT, La., Frith Sales Co.
SOMERVILLE, Mass., Insulation Products, Inc.
ST. LOUIS, Mo., Refrigeration Supplies, Inc.
ST. PAUL, Minn., Asbestos Products, Inc.
SYRACUSE, N. Y., Burnett Process, Inc.
TALLAHASSEE, Fla., Baker Bros., Inc.
TAMPA, Fla., Eagle Roofing & Art Metal Works, Inc.
TULSA, Okla., Ball Distributing & Engr. Co.
TUPELO, Miss., Paine Supply Co.
VALDOSTA, Ga., Baker Bros., Inc.
WASHINGTON, D. C., Walter E. Campbell Co., Inc.
WAYCROSS, Ga., Baker Bros., Inc.
WEST PALM BEACH, Fla., Southern Metal Prod. Co.
WICHITA, Kans., Wichita Sheet Metal, Inc.

Circle 601 on postcard, page 33

As efficient as it looks, thanks to G-B SNAP*ON®

For immaculate appearance, plus efficient thermal protection, specify G-B Snap*On, the original one-piece pipe insulation molded of fine glass fibers. In the equipment room pictured above, 3′ lengths of canvas-covered G-B Snap*On were installed, then painted for an attractive finished job.

G-B Snap*On's thermal efficiency is second to none among all general purpose pipe insulations. In fact, it usually requires less thickness of G-B Snap*On to equal the "C" factor rating of many other insulating materials. Lightweight and easy to handle, G-B Snap*On's rugged glass fiber construction makes it less susceptible to on-the-job damage. Permanent as glass itself, G-B Snap*On does not rot, corrode, mildew or otherwise deteriorate. It is available in 3′ lengths plain or with a variety of factory-adhered facings, from copper tubing diameters up to 36″ IPS, and in 6′ lengths without facings. Write today for complete information.

GUSTIN-BACON *Manufacturing Co*

232 W. 10th St., Kansas City, Mo.

Thermal and acoustical glass fiber insulations . . . Molded glass fiber pipe insulation
Couplings and fittings for plain and grooved end pipe

AVAILABLE from Advertisers

Guide to literature offered this month in ads received by PLANT ENGINEERING before the first of last month

MAINTENANCE

To Combat Corrosion—Technical Bulletins cover Imlar vinyl coatings, Corlar epoxy finishes. E. I. du Pont de Nemours & Co., Inc.
Circle 201 on Post Card

Selecting Paint?—Slide Guide gives answers on finishes, primers, thinners. Barreled Sunlight Paint Co.
Circle 202 on Post Card

Epoxies for Repairs—Information on Bakelite epoxy resin compounds. Union Carbide Plastics Co.
Circle 203 on Post Card

Safety at All Levels—Catalog shows corrosion-resistant steel and aluminum mobile ladders. Ballymore Co.
Circle 204 on Post Card

Brushes for All Uses—Facts on brushes for all types of industrial needs. Newark Brush Co.
Circle 205 on Post Card

CONSTRUCTION

Steel Retaining Walls—Catalog gives construction, cost benefits. Armco Drainage & Metal Products, Inc.
Circle 206 on Post Card

Build Big, Save Big—Facts on quality prefab building. Butler Mfg. Co.
Circle 207 on Post Card

Safety Underfoot—Bulletins describe abrasive and diamond-patterned floor plates. Alan Wood Steel Co.
Circle 208 on Post Card

Grating for Catwalks—Catalog gives specifications, load charts on safety grating. The Globe Co.
Circle 209 on Post Card

Solid Stepping Underfoot—Reasons for installing Multigrip steel floor plate. United States Steel.
Circle 210 on Post Card

125 Fasteners—Information on variety of types. Ramset Olin.
Circle 211 on Post Card

PACKINGS, SEALS, WASHERS

More Protection per Dollar—Chempro Teflon packings described in Bulletin CP552 with prices. Chemical & Power Products, Inc.
Circle 212 on Post Card

Controlled Density Gaskets—Catalog A-176 tells how they offer unusual sealing. Garlock Inc.
Circle 213 on Post Card

Severe Duty Piston Rings—Catalog AD-178 describes these and other packings. Garlock Inc.
Circle 214 on Post Card

PUMPS, COMPRESSORS

Standard Centrifugals—Circular 190 covers pumps for general, chemical use. Dean Brothers Pumps Inc.
Circle 216 on Post Card

Pumping Problems?—Bulletin 100-PE tells how Moyno pumps solve them. Robbins & Meyers, Inc.
Circle 217 on Post Card

To Speed Production—Bulletin E Covers advantages of rotary air compressors. Davey Compressor Co.
Circle 218 on Post Card

Air Compressors—Bulletin SG-3 describes units for all services. Le Roi Div., Westinghouse Air Brake Co.
Circle 219 on Post Card

Dependable Air Power—Bulletin describes air-cooled compressor with after-cooler. Gardner-Denver Co.
Circle 220 on Post Card

Stationary Compressors — Bulletin 1604-15 tells features of compact vertical units. Joy Mfg. Co.
Circle 221 on Post Card

LIGHTING

For Better Lighting—"Guide to Modernization and Relighting" gives pointers. Day-Brite Lighting, Inc.
Circle 222 on Post Card

Fluorescent Light Guide—Handy chart helps you select system components. General Electric Co.
Circle 223 on Post Card

MECHANICAL POWER TRANSMISSION

Variable-Speed Drives—Product information on Lube-Free drives. Sterling Electric Motors, Inc.
Circle 225 on Post Card

Ready to Install—Bulletin describes "package" drives. Square D Co.
Circle 226 on Post Card

No-Slip Drives—Book 2425 describes silent chain drives. Link Belt Co.
Circle 227 on Post Card

Long-Life Reducers—Information on compact, low-cost gear reducers. The J. B. Ehrsam & Sons Mfg. Co.
Circle 229 on Post Card

VALVES, TRAPS, FITTINGS

Corrosion Resistant Valves—Information on Grinnell-Saunders Diaphragm valves. Grinnell Co.
Circle 230 on Post Card

Valve Varieties—Catalog presents wide selection of air and hydraulic valves. Logansport Machine Co.
Circle 231 on Post Card

Holding Temperature—Case History 185 details practical temperature control setup. Sarco Co., Inc.
Circle 232 on Post Card

For Easier Handling—Folder PF-2 covers packaging system for steel fittings, etc. Henry Vogt Machine Co.
Circle 233 on Post Card

ELECTRICAL

Improved Motors—Bulletin 520-PE shows design and construction features. Robbins & Myers, Inc.
Circle 235 on Post Card

More KVA per Pound—Folder AC 100 describes lighter, smaller, cooler transformers. Acme Electric Corp.
Circle 237 on Post Card

Compact Control Centers—Facts on selection in "Motor Control Center Handbook." Cutler-Hammer, Inc.
Circle 238 on Post Card

Rugged, Compact Switches—Catalog 83 features LN switches in two contact arrangements. Micro Switch.
Circle 240 on Post Card

Plus Protection—Bulletins FIS, HCS tell of Fusetron dual-element and Buss Hi-Cap fuses. Bussman Mfg. Div., McGraw-Edison Co.
Circle 243 on Post Card

Versatile Cable—Catalog S-2 describes mineral insulated cable for jobs up to 600 v. General Cable Corp.
Circle 244 on Post Card

Improved Conduit—Sample, cost data on Liquatite, flexible conduit with molded jacket. Electri-Flex Co.
Circle 245 on Post Card

Electrical Protection — Brochure, "Specify Silicone Insulation and Save" gives data. Dow Corning Corp.
Circle 246 on Post Card

TOOLS, MACHINE SHOP

Work Ability Tools—Catalog describes wrenches and hand tools. Snap-On Tools.
Circle 247 on Post Card

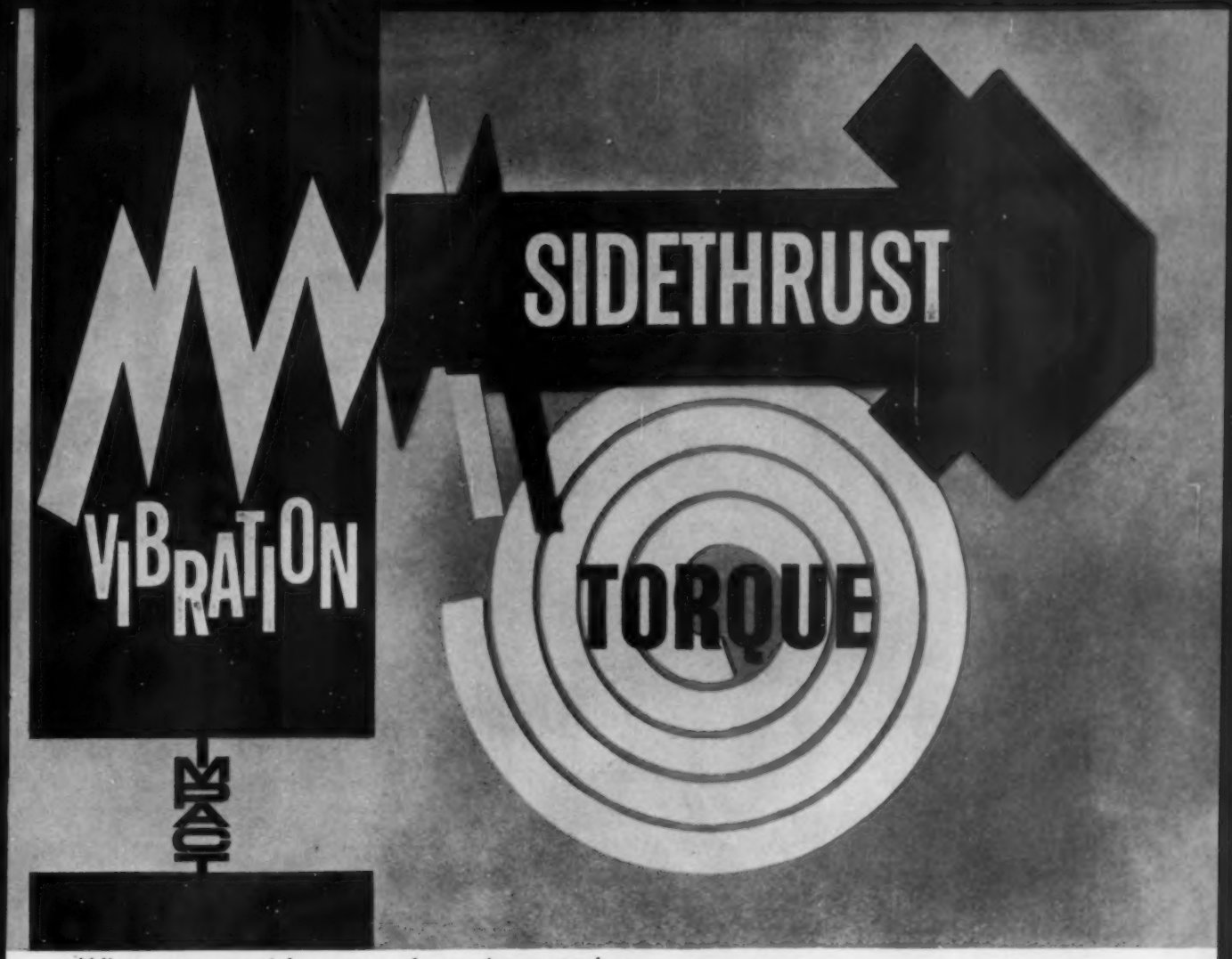
Better Pipe Tools—Catalog describes reversible, standard, V-tooth chain tongs. Armstrong Bros. Tool Co.
Circle 248 on Post Card

MATERIALS HANDLING

Conveying Problems? — Overhead Conveying Equipment Catalog offers solutions. Coburn Products, The Colorado Fuel and Iron Corp.
Circle 249 on Post Card

For Overhead Handling—Book 2008 describes light, versatile cranes. Cleveland Tramrail Div.
Circle 250 on Post Card

Postage-free cards for ordering literature are on pages 33-34.



When you grout heavy equipment, remember:

EMBECO GROUT STANDS UP BEST AGAINST THESE OPERATING FORCES BECAUSE EMBECO IS NON-SHRINK

Plain grout shrinks . . . leaves only a thin web of mortar (and the shims) that frequently fails to adequately support the baseplate under the pounding of these powerful operating forces. Result: mis-alignment . . . a costly, short-life grout.

EMBECO grout is non-shrink . . . flows easily into place . . . gives full support of baseplate. EMBECO grout is tough, high strength, oil resistant. Result: maintains alignment . . . a tight, long-life grout.

EMBECO grouts for good. It's the choice of leading heavy equipment manufacturers because of its outstanding performance record.

Before you grout another piece of heavy equipment—write for full information on the benefits you can get with EMBECO Non-Shrink Grout.

The Master Builders Company
Cleveland 18, Ohio
Division of American-Marietta Co.
World-wide manufacturing and service facilities

MASTER BUILDERS. EMBECO*

*EMBECO is a registered trademark of The Master Builders Co. for its specially prepared, flowable, non-shrink grouting products.

Circle 602 on postcard, page 33

ROYAL Portable Cords

Open a carton of Royal portable cord and you *know* you're getting the easiest handling, fastest working cord available anywhere. Flex it, crimp it, strip it . . . and you can see why Royal cord meets *all* your job requirements for flexibility, safety, and durability. Royal's reputation for quality and dependability rate Royal Cords *first* among electrical men from coast to coast. Your wholesaler has a complete range of cord types and sizes — rubber, neoprene, plastic jackets — fixture wires, lamp cords — thermo cables, coaxial cables, bell and machine tool wires, and more. They're made right, packaged right, priced right—start to use them today!

ROYAL ELECTRIC ...an associate of ULT

ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND
In Canada:
Royal Electric Company (Quebec) Ltd., Pointe Claire, Quebec

Circle 603 on postcard, page 33

Lower Handling Costs—Bulletin 530 describes Airstream conveyors for bulk materials. Dracco Div.

Circle 251 on Post Card

For Rugged Cranes—Bulletin 900-5PE covers build-it-yourself components. Robbins & Myers, Inc.

Circle 252 on Post Card

For Dependable Lifting—Catalog describes Lodestar electric Hoists. Chisholm-Moore Hoist Div.

Circle 253 on Post Card

What Kind of Sling?—Bulletins 5308-R, 5886 give selection data on slings. Macwhyte Wire Rope Co.

Circle 254 on Post Card

Floor Savers—Handbook gives facts on easy-rolling casters, wheels. Darnell Corp., Ltd.

Circle 255 on Post Card

WATER TREATING

Scale Problems? — Brochure covers consulting service on water use and disposal. Hall Laboratories.

Circle 256 on Post Card

Slime Control—Bulletin 605 reviews protection of cooling tower wood. Betz Laboratories, Inc.

Circle 257 on Post Card

OTHER EQUIPMENT

Danger Warnings — Catalog illustrates hundreds of accident-prevention signs. Stonehouse Signs.

Circle 258 on Post Card

Steel Equipment—Catalog illustrates over 1500 items—shelving, cabinets, etc. Lyon Metal Products, Inc.

Circle 259 on Post Card

Engineered Equipment—Catalog A-661 presents finishing, processing equipment. The R. C. Mahon Co.

Circle 260 on Post Card

Plant Privacy—Industrial fencing for security, traffic control detailed in catalog. Anchor Fence.

Circle 261 on Post Card

Hydraulic Cylinders — Engineering Data File catalog covers 10,000 psi units. Owatonna Tool Co.

Circle 262 on Post Card

For Economical Operation—Bulletins 120, 132 describe air-cooled exchangers. Niagara Blower Co.

Circle 263 on Post Card

Electrical Systems—Four brochures cover emergency lighting, test equipment, time control, fire alarm systems. The Standard Electric Time Co.

Circle 264 on Post Card

Using Compressed Air? — Catalog 1000 details complete line of pneumatic products. C. A. Norgren Co.

Circle 265 on Post Card

Direct Gas-Fired Heaters—Handbook "Industrial Application of Direct Gas-Fired Heaters." Reznor Mfg. Co.

Circle 266 on Post Card

Now Available...

52-PAGE REPRINT OF

HOW TO DESIGN
PNEUMATIC-HYDRAULIC ACTUATION SYSTEMS

HOW TO DESIGN
PNEUMATIC-HYDRAULIC ACTUATION SYSTEMS
FIRST IN A SERIES OF ARTICLES
Facts About Single-Acting Cylinder
reprinted from Plant Engineering magazine

THIS SERIES of articles was written to show plant engineering personnel the many ways in which fluid power equipment will help them in problems of machine motivation.

Understanding pneumatic-hydraulic system design helps plant engineers to improve existing systems, create better designs for new systems and make better use of fluid power equipment to relieve bottlenecks in their plants.

$1.50 per copy

CONTAINS THE FOLLOWING CHAPTERS:

1. Rapid approach and rapid retraction of a tool to a workpiece.
2. Designing a pneumatic system for feed approach and rapid retraction.
3. Designing a pneumatic system for rapid advance, feed cycle and rapid retraction.
4. Designing a pneumatic system for rapid approach, feed, skip, feed and rapid retraction.
5. Designing a pneumatic system for a reciprocating cycle controlled by adjustable timers.
6. Designing handling and moving devices for parts and materials during production.
7. Designing a pneumatic system for ejecting or otherwise moving the workpiece.
8. Designing a pneumatic system for workpiece movement using hydraulic control.
9. Controlling amount of movement by the use of various pneumatic circuits.
10. Designing pneumatic systems for automatic movement of the work and the tool.
11. Designing pneumatic-hydraulic systems for positioning workpiece for testing and gaging.
12. Designing pneumatic-hydraulic systems for moving the workpiece and the tool.

The Editor, Plant Engineering
308 East James St.
Barrington, Ill.

Enclosed is my check in the amount of $..... for which please send me .... copies of the reprint "How to Design Pneumatic-Hydraulic Actuation Systems".

Name .....

Title ..... Company.....

Street .....

City ..... State.....

BULLETINS

(Begins on page 31)

Continuous On-Stream Analysis

Details on the Chemonitor, for on-stream analysis of critical constituents in water, are presented in this 16-pp brochure. Hagan Chemicals & Controls, Inc.

For a copy, circle 148 on Post Card

Advanced Load Cell System

Twelve-pp Bulletin R-2 illustrates uses of remote indicating load cell systems, suggests ideas for applications not commonly known. Provides data for in-plant engineering of projects. W. C. Dillon & Co., Inc.

For a copy, circle 149 on Post Card

INDUSTRIAL TRAINING

Industrial Electronics Instruction

Home study courses in electronics are presented in this 64-pp catalog. Objectives of each, along with fields of application, are outlined. Covers such courses as basic electricity, electric control circuits, digital circuits. DeVry Technical Institute.

For a copy, circle 151 on Post Card

Technical Training Facilities

Technical training programs available to industry are described in this 16-pp brochure. Discusses training programs at company's own centers; training programs at industrial plants; and on-the-job training. Also discusses home study courses. Tech-Rep Div., Philco.

For a copy, circle 152 on Post Card

Training Electronics Personnel

This 32-pp booklet outlines potentials offered through home study in electronics, with emphasis on value to industrial employers. Contains comprehensive catalog section describing in detail the technical courses offered . . . master course in electronics, advanced engineering. Cleveland Institute of Electronics.

For a copy, circle 153 on Post Card

TOOLS, WELDING AND MACHINE SHOP

Tool Selection Made Easy

Detailed selection data on tools holders, set-up and hold-down tools, tool bits, machine shop specialties, wrenches, socket wrenches, sets containing wrenches and detachable sockets, miscellaneous hand tools and pipe tools are in 132-pp Catalog 700. Armstrong Bros. Tool Co.

For a copy, circle 154 on Post Card

Portable Electric Tool Guide

Detailed specifications, application data and photos on electric saws, sanders, drills, planes, routers, shapers, grinders and accessories are included in 36-pp Catalog 109. The Porter-Cable Machine Co.

For a copy, circle 155 on Post Card

Portable Machining Tools

Bulletin VM-60-C, 6 pp, describes the compact Versa-Mil designed to handle all tooling needs and let you take the machine to the job. Gives specifications on three sizes, lists attachments, arbors. The Dumore Co.

For a copy, circle 156 on Post Card

On Welding Mild Steel

This 20-pp catalog provides specifications, operating characteristics, properties, applications etc. on mild steel and low hydrogen electrodes for fabricating mild and alloy steels. Reference charts list recommended electrodes in welding trade name steels and ASTM carbon and low alloy steels. Also included are sections on terminology. The McKay Co.

For a copy, circle 157 on Post Card

Welding Pressure Lines, Systems

Twenty-pp Bulletin 2112.2 gives tips on techniques and costs related to transmission and pressure piping systems. Describes hand welding techniques; covers API pipe specifications, analysis, properties. Includes chart on pounds of electrode consumed per joint for various size pipe, hand or automatic submerged arc welding. The Lincoln Electric Co.

For a copy, circle 158 on Post Card

Vibration-Control Machine Mounts

Wedgmounts, Jacmounts and Air-Locs are described in Catalog 4011. Physical properties of mounting material. Clark-Cutler-McDermott Co.

For a copy, circle 159 on Post Card

DUST, FUME CONTROL

Centrifugal Dust Separator

Performance data, selection and dimension charts, and installation photos on cyclonic separators for high-temperature or abrasive dusts are presented in 12-pp Bulletin E-221. The Day Co.

For a copy, circle 160 on Post Card

High Efficiency Gas Scrubbers

Catalog 150 describes Impinjet scrubbers for economical wet cleaning, absorption or cooling of gases. Dimensions given for single and multiple stage units, capacities to 38,000 cfm. The W. W. Sly Mfg. Co.

For a copy, circle 161 on Post Card

PUMPS, COMPRESSORS

Close-Coupled End-Suction Pumps

Bulletin 117 PKG introduces packaged centrifugal pumps offering compactness, design simplicity, easier installation. Provides sectional views, construction specifications, performance charts. The Aurora Pump Div., The New York Air Brake Co.

For a copy, circle 162 on Post Card

Single-Stage Chemical Pumps

Heavy-duty chemical pumps with maximum interchangeability of parts are featured in 8-pp Form 70288, with coverage chart, dimensional diagrams included. Ingersoll-Rand Co.

For a copy, circle 163 on Post Card

Flexible Process Pumps

Featured in 8-pp Bulletin 1-210 are process pumps designed for maximum interchangeability of parts to meet service requirements. Byron Jackson Pumps, Inc.

For a copy, circle 164 on Post Card

Pump for Handling Resins

Triplematic pump for proportioning, mixing and dispensing two and three part multi-component resin systems is featured in this 10-pp bulletin. H. V. Hardman Co., Inc.

For a copy, circle 165 on Post Card

Hydraulic Power Units

Miniaturized hydraulic pumps, as well as cylinders, relief valves, pressure switches and accessories for a complete hydraulics installation are featured in 76-pp Catalog 21. Includes selection data, pressure curves, wiring diagrams, mounting dimensions. Oil-Dyne, Inc.

For a copy, circle 166 on Post Card

Pump and Heater Units

Data and specifications on fuel oil pumps and heater units, with general layout and foundation requirements and fuel oil data are in 8-pp Catalog 60-2. Faber Engineering Co., Inc.

For a copy, circle 167 on Post Card

Heavy Duty Air Compressors

Performance details and basic construction features of heavy duty air compressors for continuous operation are detailed in 36-pp Bulletin A-43. Data tables and fold-out drawings included. Joy Mfg. Co.

For a copy, circle 168 on Post Card

Postage-free Reader Service Cards for your convenience in ordering these bulletins are provided on pages 33-34. You may also use the post cards for ordering literature mentioned in ads.

Two-Cycle Compressor Performance

Details on performance characteristics of turbocharged two-cycle gas engine driven compressors in variable-load applications are presented in Bulletin 205. Clark Bros. Co.

For a copy, circle 169 on Post Card

The Compressor Valve Story

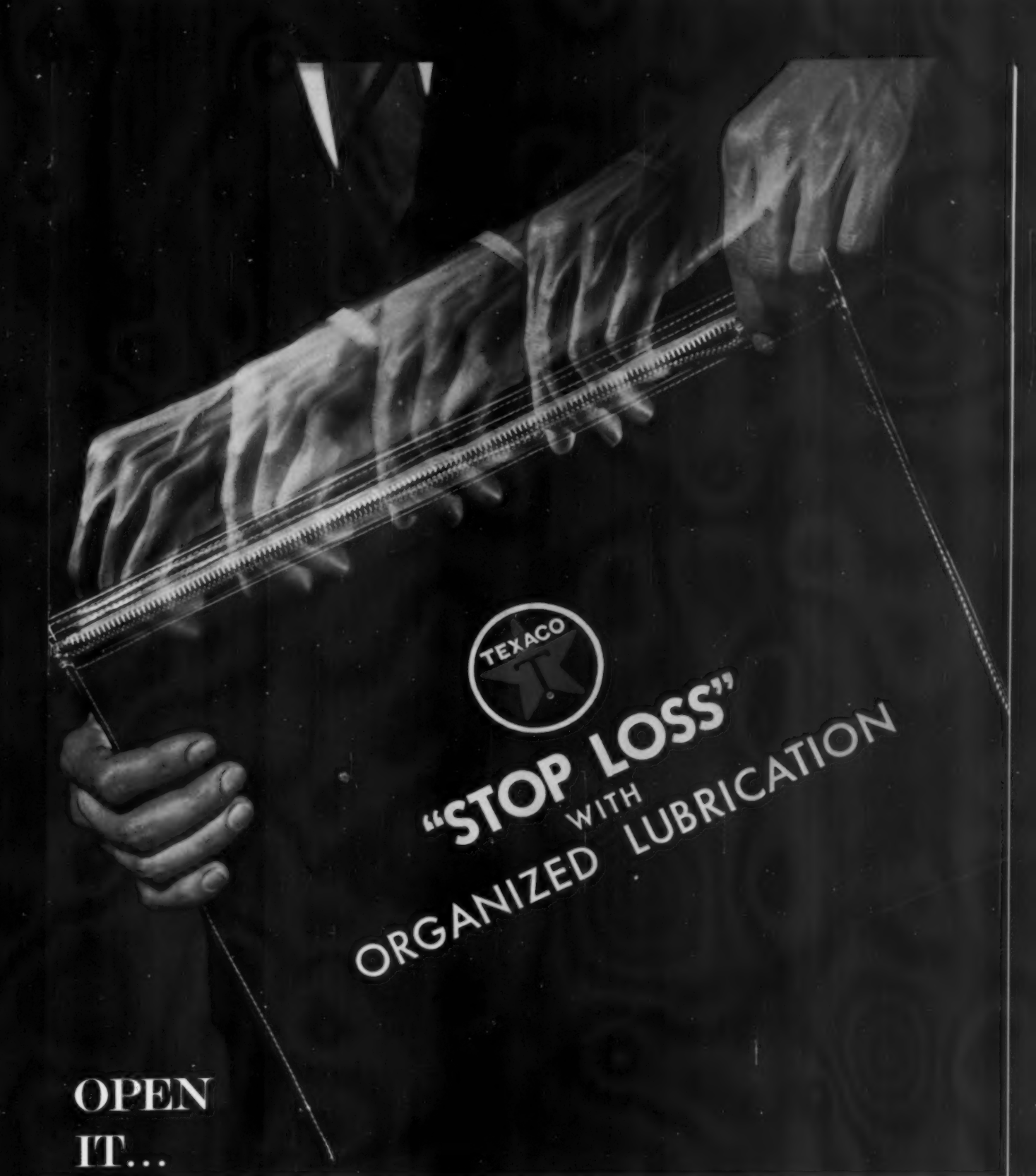
Operation and importance of valves in modern reciprocating compressors are described in 44-pp Form 3222. Question-and-answer format details demands made on valves and their function in a compressor. Booklet traces evolution of valving from 18th century. Ingersoll-Rand Co.

For a copy, circle 170 on Post Card

HEAT EXCHANGERS

Counterflow Block Heat Exchangers

Featured in 8-pp Catalog Section S-6813 is an impervious graphite coun-



OPEN IT...

FOR UP TO 4% EXTRA NET PROFIT

In the Texaco man's briefcase is a plan for cost control through organized lubrication—Texaco's "Stop Loss" Program. Management in many different industries is already using it to cut operating costs. The resulting savings go directly into profits. Up 4% is the average. To find out how you can turn excessive costs into profit, write for our informative folder: "How to Starve a Scrap Pile." **TEXACO** INC., 135 East 42nd Street, New York 17, N. Y. Dept. E-201

EXIDE POWER PACKAGE

Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa. (ESB)

85 AMP-HR—ONLY 22⅝ in. HIGH!

Here's the new high in battery capacity for electric industrial trucks—the Exide-Ironclad TSC Battery. It is available right now and it will fit in the battery compartments of your present trucks without modification. It conforms to the design thinking for future trucks as expressed by truck manufacturers.

This battery offers a capacity of 85 amp-hr per positive plate—increased from the previous highest available capacity of 80 amp-hr in the Exide-Ironclad TGS—and still with over-all height of 22⅝ in. The length and width dimensions of the battery are also unchanged. Therefore the new battery occupies the same space as present batteries.

A unique feature of the Exide-Ironclad Battery is the tubular construction of the positive plates. With the square-shaped tube, introduced over a year ago in the TGS Battery, Exide made it possible to get higher capacity from each positive plate through greater area in contact with the electrolyte.

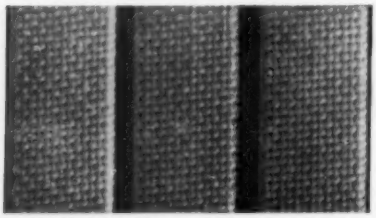
Now, in the TSC Battery, Exide introduces woven mesh tubing, still square shaped, but with higher porosity for easier access of electrolyte. This new tubing is able to hold more active material, which, in addition to the higher porosity, results in higher capacity than ever before. The tubing is of a special nonoxidizing material of proven long life in extensive laboratory tests and field applications.

This increase in battery capacity has been achieved without increasing the height of the battery. Thus you can step up the work capacity of your present trucks without the extra expense of modifying the battery compartments. The Exide-Ironclad TSC is still only 22⅝ in. high. Likewise its specific gravity is still only 1.275. Hence battery life potential remains high.

With the introduction of the Exide-Ironclad TSC, Exide now makes it possible for you to match your particular battery power requirements more closely than ever. If you are ready to buy a new truck or new battery now, talk with your Exide representative about how you can get the maximum power for your dollar.

Only Exide offers so broad a range of battery types: Exide-Ironclad, Exide-Powerclad premium flat plate, and Exide Nickel-iron alkaline (invented by Thomas A. Edison). Exide chargers are available in both motor-generator and silicon rectifier types, in sizes to cover all needs. Exide service men are coast to coast, all factory trained in both batteries and chargers.

Make sure you get maximum economy in your battery power. Write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



New tubing boosts battery capacity

Side view of tubing magnified twice size shows the fine mesh with thousands of pores for easy flow of electrolyte. Holds active material firmly against loss.

Exide®

Circle 606 on postcard, page 33

BULLETINS

(Begins on page 31)

terflow block heat exchanger, with dimensional data, fluid flow patterns and pressure drop characteristics included. National Carbon Co.

For a copy, circle 171 on Post Card

Heat Exchangers, Aftercoolers

Eight-pp Bulletin 715 contains latest information on aftercoolers, and shell and tube type heat exchangers, along with design and operating details, specifications. R.P. Adams Co., Inc.

For a copy, circle 172 on Post Card

SAFETY, SANITATION

Fire Fighting with Fog

Twenty-four questions on fighting fires with high pressure fog are answered in this 24-pp booklet. Includes testimonials from industrial and other fire chiefs, also describes mobile and stationary fire equipment. John Bean Div., Food Machinery & Chemical Corp.

For a copy, circle 173 on Post Card

Fiber Glass Safety Ladder

Described in Form 104 is a non-conducting, non-absorbent, lightweight ladder for safe use around high voltages, moisture, chemicals, acids, fumes, gases. Aluminum Ladder Co.

For a copy, circle 174 on Post Card

Contemporary Washroom Design

Bulletin A1418 gives descriptive and dimensional data on washfountains and group showers, tabulating minimum practical clearances for group units. Bradley Washfountain Co.

For a copy, circle 175 on Post Card

Industrial Sanitation Supplies

Among the products featured in this 118-pp catalog are floor and vacuum machines, cleaners and waxes, disinfectants and deodorants, hand soaps and dispensers. Also presents a wide range of janitorial supplies as well as chemicals and equipment for pest control. Lien Industrial Co.

For a copy, circle 176 on Post Card

LANDSCAPING, GROUNDS

Weed, Brush Control Guide

This 12-pp bulletin deals with industrial vegetation problems and selection of right chemical or combination for their control. Discusses weed and brush killers. E. I. du Pont de Nemours & Co.

For a copy, circle 177 on Post Card

For Economical Snow Removal

Stationary, semi-mobile and mobile thermal snow melters are described in Bulletin 118, giving fuel consumption, sizes. Tells how to calculate size for specific area. Thermal Research & Engineering Corp.

For a copy, circle 178 on Post Card

Flat end snubs against object and grips where rounded nose pliers would fail.
Deep cut-teeth provide secure grip. Curved sections have large, deep-broached teeth to grip pipe, etc.
Special slotted washer and chamfered nut provide lockwasher action — will not work loose.
Overlap shear action cuts better — saves edge . . . provides non-slip action.
Star chamfer holds rivet from turning — holds jaws in alignment.
Special hardening and precisely machined joints keep needle-nose jaws in line.

Tips for Measuring the Real *Work Ability* of Pliers

Check the photos above. Shown here are features you have a right to expect in a plier or cutter — features you *get* when you buy SNAP-ON.® In addition, SNAP-ON gives you —

Through hardening for extra toughness.

Broached stud-positioning hole for true bearing surface and snug, easy-working joint.

Drilled and reamed rivet holes on needle-nose for easy use.

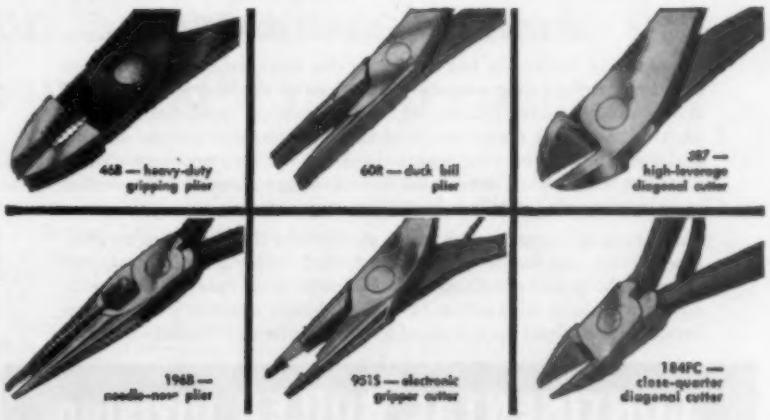
Broached and ground joint surfaces for smooth operation, snug fit.

Engineered handle design for correct leverage.

Over 60 models and sizes to let you choose the best one for your production or maintenance job.

Your SNAP-ON Sales Engineer can give you more information on the complete plier line. There's a SNAP-ON Branch Office in every major U.S. industrial center.

Or write for catalog listing the complete series, plus full range of wrenches and hand tools.


448 — heavy-duty gripping plier
60R — duck bill plier
387 — high-leverage diagonal cutter
196B — needle-nose plier
951S — electronic gripper cutter
184FC — close-quarter diagonal cutter

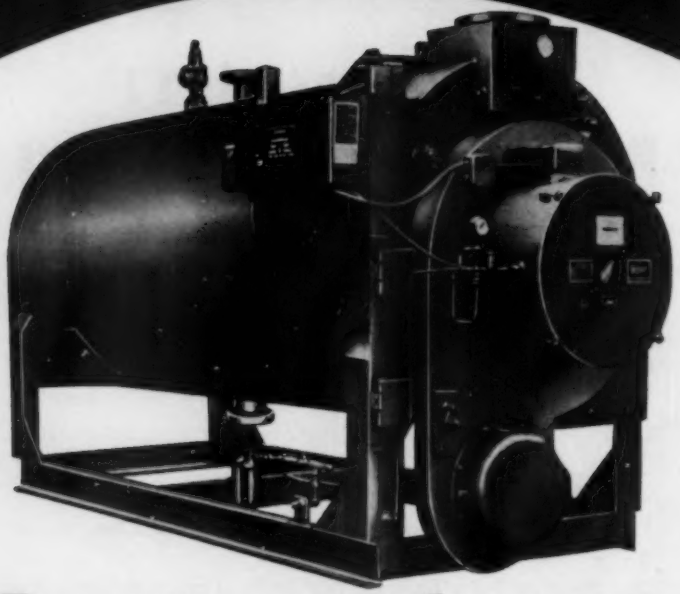
FOR ALL INDUSTRY

SNAP-ON TOOLS

8068-G 28th AVENUE • KENOSHA, WISCONSIN

Circle 607 on postcard, page 33

GUARANTEED against damage from "THERMAL SHOCK"!



Continental 2-PASS

AUTOMATIC HOT WATER BOILERS

575,000 BTU to 23,435,000 BTU

Continental Boilers in hot water service have established an outstanding performance record—*no* failures or damage from thermal shock have occurred among *all* units in service. Low, medium and high temperature operation is included in various system designs and under widely varying seasonal conditions. This proven performance has resulted in Continental Boilers being approved and specified in ever-increasing numbers by design engineers.

Now the positive assurance which stems from these years of trouble-free service has led to an unprecedented *3-year guarantee* against thermal shock damage. Continental's "code-plus" construction methods and unique adaptation of 2-Pass design deserve your further investigation. Send for details of new guarantee and Bulletin BE-200.

CONTINENTAL BOILER Division
BOILER ENGINEERING & SUPPLY CO., Inc.
Phoenixville, Pennsylvania
Nationwide Sales and Service in Principal Cities

Circle 608 on postcard, page 33

BULLETINS

(Begins on page 31)

OTHER EQUIPMENT

Efficient Roof Ventilators
Engineering data on roof ventilators, fans and blowers—including the Vertijet, automatic Airjet, reversible, mushroom head and stack cap types—is presented in 16-pp Bulletin A-112E. Hartzell Propeller Fan Co.
For a copy, circle 179 on Post Card

Pneumatic Communication Systems
Beginning by explaining time-cost factors of business paper handling, this lavishly illustrated 40-pp catalog goes on to discuss benefits of pneumatic tube systems. Describes three basic types: conventional, semi-automatic and automatic; presents components of each. Lamson Corp.
For a copy, circle 180 on Post Card

Incinerator Selection Data
"The Blue Book of Incinerators" contains 16-pp of data on selecting incinerators for all types of applications, factors to consider in layout and specifications. Joseph Goder, Inc.
For a copy, circle 181 on Post Card

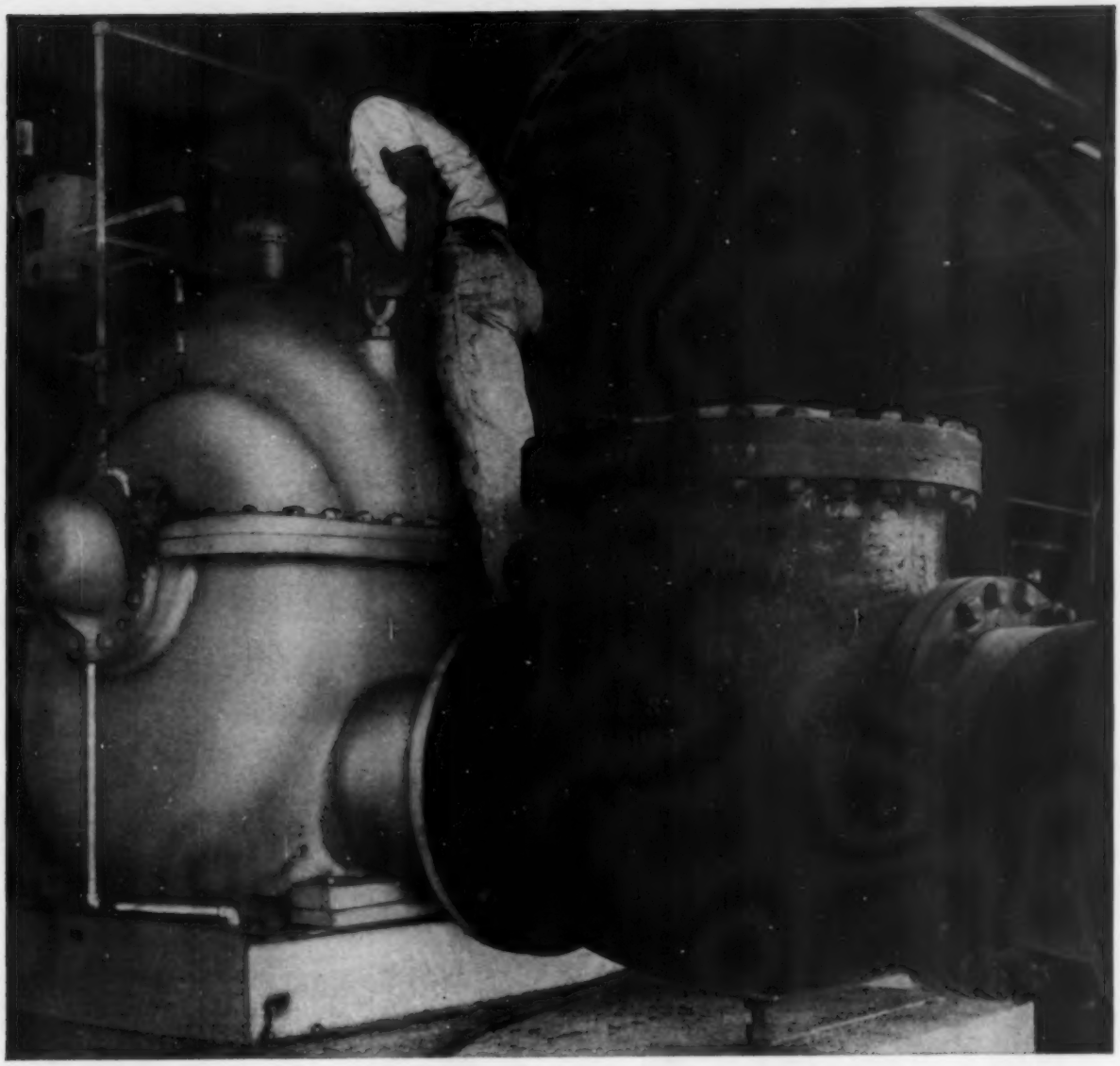
Compounds for Metal Working
Some 43 materials for metal cleaning, phosphating, conversion coatings, protective coatings, paint and carbon removers, descalers, rust removers and preventive coatings are described as to basic purpose and application method in this 12-pp bulletin. Turco Products, Inc.
For a copy, circle 182 on Post Card

Maintenance, Safety, Equipment
Diversified equipment is described in 64-pp Catalog 33. Presents rotary burs and files, metal-cutting saws, test instruments, electric etchers, electric motor maintenance devices, protective masks, eyeshields, and respirators. Martindale Electric Co.
For a copy, circle 183 on Post Card

Industrial Rubber Products
This 60-pp catalog features data on transmission belts; conveyor and elevator belts; air, water, oil, fire and sand suction hose, and molded rubber products and specialties. Mechanical rubber products are indexed by name of intended service. Cincinnati Rubber Mfg. Co.
For a copy, circle 184 on Post Card

Fasteners and Corrosion Resistance
Various types of corrosion and metals suited to resist them are reviewed in this 24-pp Corrosion Guide. A chart for specifying fasteners shows chemically equivalent specifications of metal fasteners, method of manufacture, ASTM specifications. The H. M. Harper Co.
For a copy, circle 185 on Post Card

For Milling, Drilling and Boring
Contained in this general catalog is information on Ogesto and Beaver shank milling, drilling and boring



Nickel Cast Iron...economical way to get strong, pressure-tight pump casings

This pump casing contains 2% nickel – enough to make a big difference in performance at a practical cost.

St. Regis Paper Co. depends on the pump to deliver 20,000 gmp of circulating water to condensers and evaporators at its Jacksonville, Fla. plant. Because the circulating water is brackish – often almost pure seawater – the pump casing must withstand heavy corrosive and erosive attack. But these are only a few of the reasons why 2% nickel cast iron was used by the pump's builder, C. H. Wheeler Manufacturing Co., Philadelphia.

Nickel helps cast for strength, tightness, machining benefits. Right in the foundry, Nickel helps provide accurate control over properties wanted in a casting. Nickel cast irons offer great resistance to corrosion, erosion and wear. Nickel helps castings form a uniformly dense grain structure, helps increase pressure-tightness by minimizing porosity. Besides increasing strength, adding nickel to the melt means improved machining properties – which can save production costs on many types of cast fluid-handling equipment.

The useful 32-page booklet, "Engineering Properties and Applications of Nickel Cast Irons" describes these and other important advantages. A postcard will bring it to you.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street New York 5, N. Y.

INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

Circle 609 on postcard, page 33

BULLETINS

(Begins on page 31)

accessories; adjustable quick-change tools for tape control or conventional machines; precision adjustable boring units and boring insert units for semi-finish and finish operations; boring bars, heads and bar blanks. Beaver Tool & Engineering Corp.

For a copy, circle 186 on Post Card

Insulating Firebrick Data

Advantages of insulating firebrick, as well as charted information on application and selection, are presented in 36-pp Bulletin R-38. The Babcock & Wilcox Co.

For a copy, circle 187 on Post Card

Replaceable Air Filters

Characteristics and applications of Micromat filter media for use in air conditioning, heating and ventilating are detailed in this product bulletin. Microtron Corp.

For a copy, circle 188 on Post Card

Conveyor Order Picking Control

Bulletin GEA-7219, 8 pp, describes a distribution warehousing system for case goods order picking. Explains equipment and operating method of continuous flow system, which operates from punched card or keyboard input. General Electric Co.

For a copy, circle 189 on Post Card

Planning Plant Construction

Eight-pp Bulletin 116 covers consulting services available from site selection and development, design, and plant engineering through construction and management. Lester B. Knight & Associates, Inc.

For a copy, circle 190 on Post Card

Dry Materials Conditioner

Featured in Bulletin 5002-2 is the Verticone conditioner for dust-free handling of bulk dry materials by continuous controlled wetting. Johnson-March Corp.

For a copy, circle 191 on Post Card

Efficient Document Filing

How Pack Interlock files and filing system save time, money and space, with greater protection for drawings and prints is told in 6-pp Form A-103. Pack Mfg. Co.

For a copy, circle 192 on Post Card

Silicones and How They're Used

Eight-pp Bulletin CDS-129C gives performance and application details on silicone fluids, protective coatings, electrical insulation and rubber. Includes selector guide for silicone rubber. General Electric Co.

For a copy, circle 193 on Post Card

Portable Table Seating

Efficiency of using portable table seating to gain multi-use of space in industrial and other areas is stressed in 20-pp Catalog 65 on quick-to-set-up seating units. Sico Mfg. Co., Inc.

For a copy, circle 194 on Post Card

Turbines with Flexibility

Bulletin GEA-7152, 8 pp, describes single-valve, multi-stage mechanical drive turbines with choice of three valve sizes and applicable to various flow requirements, condensing and non-condensing. General Electric Co.

For a copy, circle 195 on Post Card

Hydraulic Can Crusher

Details on push-button unit that "puts the pressure on cans and converts trash into cash" are given in product bulletin. Milwaukee Metal Products Co., Inc.

For a copy, circle 196 on Post Card

Versatile Leather Packings

This brochure and price list describes leather packings for hydraulic and pneumatic applications, providing measurements, prices and instructions. The Auburn Mfg. Co.

For a copy, circle 197 on Post Card

Boilers, Burners for Rent

Form 6596 introduces a lease plan covering gas and oil burners for heating and power; packaged generators; heating and temperature control systems. Explains how rental affords benefits of modern equipment without capital investment. Iron Fireman Mfg. Co.

For a copy, circle 198 on Post Card

HANSEN

SERIES HK® QUICK-CONNECTIVE

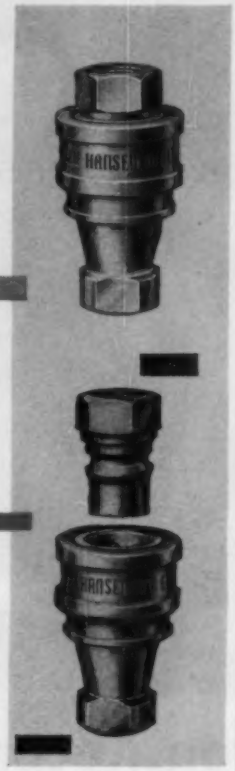
TWO-WAY SHUT-OFF COUPLINGS

QUICK FLUID LINE CONNECTION OR DISCONNECTION

WITH

INSTANT AUTOMATIC FLOW OR SHUT-OFF

Instantly shuts off both sides of line... prevents loss of liquid, gas or pressure



When Coupling is disconnected, identical valves in both the Socket and Plug provide instant shut-off of gas or liquid. To eliminate leakage or spillage during disconnection, the Coupling is so designed that shut-off takes place *before* the Plug separates from the Socket—and *before* the seal of the Socket itself, provided by the Socket "O" Ring, is broken.

In reverse, when Coupling is connected, the "O" Ring in the Socket completely seals Coupling *before* valves release flow of fluid from both sides of line—thus eliminating possibility of spurt of gas or liquid during instant of connection.

Available in brass or steel with female pipe thread connections from ⅛" to 1½" inclusive—also up to 1" in stainless steel.

Write for the Hansen Catalog

Here is an always ready reference when you want information on on couplings in a hurry. Lists complete range of sizes and types of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings —including Special Service Couplings for LP-Gas, Steam, Oxygen, Acetylene, etc.

Representatives in Principal Cities ... see Yellow Pages

SINCE 1913 QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 35, OHIO

Circle 610 on postcard, page 33

SAFETY...specify Alan Wood floor plate

Whatever your safety problem underfoot, Alan Wood has the floor plate to meet the need—Super Diamond for safe footing in usual locations – A. W. Algrip for use where oils, greases, fats, printing ink mist or other materials cause slipping hazards. Both are durable and long wearing . . . easy to install . . . simple to maintain.

SUPER DIAMOND—rugged, heavy-duty floor plate with a unique pattern arrangement that is easy to match at any point, allows bending or cutting wherever desired. Super Diamond is easily and quickly welded with ordinary equipment . . . easily swept, hosed or mopped, from any direction—drains free, with no pockets to hold dirt.

A. W. ALGRIP—world's first and only abrasive rolled steel floor plate, made by a patented process in which an abrasive is embedded to a controlled depth . . . becoming an integral part of the steel plate, and providing lasting safety. A. W. Algrip is approved for safety by Underwriters' Laboratories.

Both Super Diamond and A. W. Algrip are readily available from Steel Service Centers across the country. Send for complete information on how one of these Alan Wood safety floor plates can solve your particular safety problems . . . just mail the coupon below.

ALAN WOOD STEEL COMPANY

Conshohocken, Pa. • STEEL PRODUCERS WITH THE CUSTOMER IN MIND

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle Montreal, Toronto and Vancouver, Canada: A. C. Leslie & Co., Ltd.

ALAN WOOD STEEL CO.
Conshohocken, Pa.

For safety's sake, please send your bulletin on:
☐ **Super Diamond floor plate** ☐ **A. W. Algrip floor plate**

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

Circle 611 on postcard, page 33

DATA FILE OF LITERATURE FOR THE PLANT ENGINEER'S LIBRARY

STANDARD CATALOGS, bulletins and handbooks are described here to help plant engineers maintain a permanent data file. To order this free literature, use Reader Service Cards provided for you on pages 33-34.

MAINTENANCE

Long Run Paint Economy

Paint selection factors are detailed in the sixth edition of "Engineered Color," 20 pp. Covers proper use of paint and color, requirements of various surfaces, color and the safety program. Describes interior and exterior primers, finishers, varnishes, floor sealers. Includes color chips. Barreled Sunlight Paint Co.

For a copy, circle 301 on Post Card

Protective Coating Systems

Several protective maintenance coating systems designed to solve corrosive problems are detailed in this 16-pp bulletin. Index tab indicates where a particular system should be used. The Glidden Co.

For a copy, circle 302 on Post Card

Epoxy Chemical Resistant Enamel

Bulletin 1001 describes Corlar, an enamel for abnormal exposures to fumes, spillage and moisture. Covers characteristics, applications, coverage and preparation. E. I. du Pont de Nemours & Co., Inc.

For a copy, circle 303 on Post Card

Brushes For Industry

Catalog 200, 46-pp, on industrial brushes, tells factors to consider in power brush selection. Power and hand brushes for industrial requirements are illustrated and described. Newark Brush Co.

For a copy, circle 304 on Post Card

Pyramid Ladders, Platforms

Catalog 159, 20-pp, describes pyramid-design step ladders, hydraulic lifts and fixed or adjustable-level work platforms for above-floor working safety. Ballymore Co.

For a copy, circle 305 on Post Card

WIRE ROPE, SLINGS

Wire Rope Slings

Catalog WR-719 contains 84 pp of basic data on selection and use of slings, rules for hitching, tables of rated capacities. Includes data on fittings, assemblies, attachments. The Colorado Fuel and Iron Corp.

For a copy, circle 306 on Post Card

Use and Abuse of Wire Rope

Practical information on wire rope is presented in this pocket size 92-pp manual. Selection of wire rope, constructions, capacities, maintenance, lubrication are covered. Macwhyte Wire Rope Co.

For a copy, circle 307 on Post Card

MATERIALS HANDLING

Screw Conveyor Application

Information on selection of screw conveyors, feeders and components is presented in 78-pp Book 2989 with descriptive sections and engineering data. Lists materials for which conveyors may be used. Link-Belt Co.

For a copy, circle 308 on Post Card

Modernized Bulk Handling

Bulletin 532, 6 pp, describes combination and suction-type pneumatic conveyor systems with examples of installations ranging from automatically controlled 11-system to a small system. Dracco Div., Fuller Co.

For a copy, circle 309 on Post Card

500- to 4000-lb Capacity Hoists

Speedway electric hoists are described in 12-pp Bulletin DH-133-F. Design features and details on suspensions and conducting systems included. Wright Hoist Div., American Chain & Cable Co., Inc.

For a copy, circle 310 on Post Card

Wire Rope Electric Hoists

Six-pp Bulletin 905 describes electric wire rope hoists in capacities to 2 tons. Gives specifications, mounting options and sectionals. Hoist & Crane Div., Robbins & Myers, Inc.

For a copy, cricle 311 on Post Card

Hoists for Many Jobs

Bulletin 142-H, 26-pp, features the Meteor hoists with single- or two-speed control, and discusses suspension types, trolleys, accessories, clearance diagrams, and prices. Chisholm-Moore Hoist Div., Columbus McKinnon Chain Corp.

For a copy, circle 312 on Post Card

Vertical Transportation

Selection of vertical transportation for every traffic-moving job is detailed in 32-pp Bulletin A-382. Various elevators and escalators are described. Otis Elevator Co.

For a copy, circle 313 on Post Card

Caster and Wheel Manual

Detailed engineering data and specifications on casters and wheels for all types of applications, including light and heavy duty industrial types, are presented in 192-pp Manual 66. Darnell Corp., Ltd.

For a copy, circle 314 on Post Card

Why Self-Dumping Hoppers

Cost-saving advantages of self-dumping steel hoppers for bulk handling are detailed in Bulletin 265. Roura Iron Works, Inc.

For a copy, circle 315 on Post Card

STORAGE EQUIPMENT

Steel Shelving and Equipment

Illustrated in 8-pp Form 2715 is quick-erection, adjustable steel shelving for maximum space saving, as well as tool stands, benches, cabinets. Standard Pressed Steel Co.

For a copy, circle 317 on Post Card

Steel Equipment Selection

Catalog 100 K contains 100 pp of detailed information on steel cabinets, folding chairs, work benches, tool stands, shelving, tool storage, lockers, coat racks, filing cabinets, bins. Lyon Metal Products, Inc.

For a copy, circle 318 on Post Card

ELECTRICAL

Multi-Shielded Motor

Dimensional, selection and application data on multi-shielded a-c motors provided in Catalog 200 56-pp. Information includes modifications. Sterling Electric Motors, Inc.

For a copy, circle 319 on Post Card

Internally-Geared Reduction Motors

Internally-geared motors in single, double and triple reduction, right-angle worm-gear motors, totally-enclosed and explosion-proof gearmotors are described in 16 pp Bulletin F-1880. U. S. Electrical Motors Inc.

For a copy, circle 320 on Post Card

Distribution Transformers

Dry type distribution transformers, single and three phase, are featured in 16-pp Bulletin 5A2-BL01. Wiring diagrams provided. Acme Electric Co.

For a copy, circle 321 on Post Card

Insulated Transformer Leads

Bulletin RCT 320, 8 pp, describes PVC insulated leads for oil-filled transformers. Discusses insulation properties required for such leads (flexibility, heat stability etc.) and compares these with properties of Synthinol 901. Rome Cable Div.

For a copy, circle 322 on Post Card

Metal-Clad Switchgear

Twenty-pp Bulletin 2801-2A describes 4160-v metal-clad switchgear with stored-energy closing, closed-door drawout. Features of the roomy but compact gear, including maintenance procedures and safety provisions, are detailed. I-T-E Circuit Breaker Co.

For a copy, circle 323 on Post Card

Electrical Control Equipment

Eighty-pp Bulletin LO-11 features safety switches, service controls, load centers and accessories for electrical control equipment. Design and construction features, selection tables, case demensions, and wire tables are included. Cutler-Hammer Inc.

For a copy, circle 324 on Post Card

Distribution Panelboards

Quick-make, quick-break distribution panelboards using shuttle break fusible switches are described in Bulletin 403. Application and rating data included. Frank Adam Electric Co.

For a copy, circle 325 on Post Card

Now it's much easier to solve your pipe motion problems

. . . with new Flexonics
EXPANSION JOINT
ENGINEERING GUIDE

New convenient way to solve pipe motion problems! Flexonics Expansion Joint Engineering Guide – just off the press – contains a wealth of vital information in easy-to-read, easy-to-use form. 42 pages of calculations, tables, anchoring and guiding data. Every piping system designer needs this new book. Mail the coupon for your FREE copy!

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FLEXIBLE METAL and SYNTHETIC HOSE EXPANSION JOINTS
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Please send my free copy of the new Flexonics Engineering Guide on Expansion Joints, Expansion Compensators, and Pipe Guides and Supports.

Circle 612 on postcard, page 33

MODERNIZE–
ECONOMIZE–
STANDARDIZE–

...WITH these electrical systems by

STANDARD

TIME CONTROL SYSTEMS

PUBLICATION NO. 250

Centrally controlled, synchronized clocks, time clocks and job time recorders reduce production costs by registering time on a consistent basis throughout entire plant. Yard lights, utilities, signals programmed for automatic operation reduce personal attention required . . . eliminate human error.

FIRE ALARM SYSTEMS

PUBLICATION NO. 251

With automatic "locator" feature that permits instant identification of trouble area . . . confines fire or sprinkler damage by making possible immediate action.

ELECTRICAL TEST EQUIPMENT

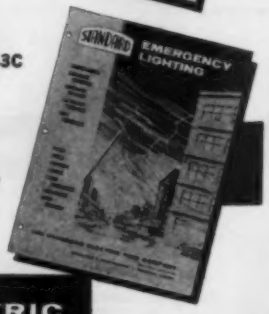
PUBLICATION NO. 247

Voltage distribution panels, test stands, control consoles—custom designed by specialists—for lab or production line test use.

EMERGENCY LIGHTING

PUBLICATION NO. 243C

For protection of personnel, plant and property.
Instantaneous, automatic operation—electrically supervised, 100% dependable, with automatic recovery.



THE STANDARD ELECTRIC TIME COMPANY
89 LOGAN STREET, SPRINGFIELD, MASSACHUSETTS

Circle 613 on postcard, page 33

DATA FILE

(Begins on page 204)

Enclosed Switches

Catalog 83, 22 pp, Catalog 84, 16 pp, and Catalog 101, 24 pp, cover enclosed switches, including general types for a-c or d-c applications, sealed switches, heavy-duty limit switches, hand operated switches, others. Micro Switch, Div., Minneapolis-Honeywell Regulator Co.

For a copy, circle 326 on Post Card

Basic Electrical Protection

Form BPB, 10-pp, gives information on interrupting capacity, speed of response, current limitation, motor protection, system selectivity to faults, fuse applications and selection. Bussmann Mfg. Co.

For a copy, circle 327 on Post Card

Electrical Equipment Digest

Presented in 168-pp Catalog Digest 143 are load centers, circuit breakers, low voltage control, fusible service equipment and accessories, meter sockets and troughs, safety switches, panelboards, duct and fittings, starters. Square D Co.

For a copy, circle 328 on Post Card

Data on Sheathed Cables

Construction details and performance information on sheathed cables, available in steel, copper, aluminum and bronze, are presented in Bulletin 1031, 16-pp. Engineering data included. Simplex Wire & Cable Co.

For a copy, circle 329 on Post Card

Safety Mineral Insulated Cable

Bulletin S-2-60, 20-pp, describes properties, applications, installation, construction and performance characteristics, and wiring specifications of mineral insulated cable for hazardous locations. Mineral Insulated Wire Div., General Cable Corp.

For a copy, circle 330 on Post Card

Rubber Power Cable

This 32-pp catalog contains information on design features, insulations and performance highlights of butyl rubber power cable. Includes data on available constructions, ampacity etc. Anaconda Wire & Cable Co.

For a copy, circle 331 on Post Card

Flexible Electrical Conduit

Performance and application data on Liquatite, the flexible plastic covered electrical conduit, is featured in this bulletin. Electri-Flex Co.

For a copy, circle 332 on Post Card

For Hazardous Locations

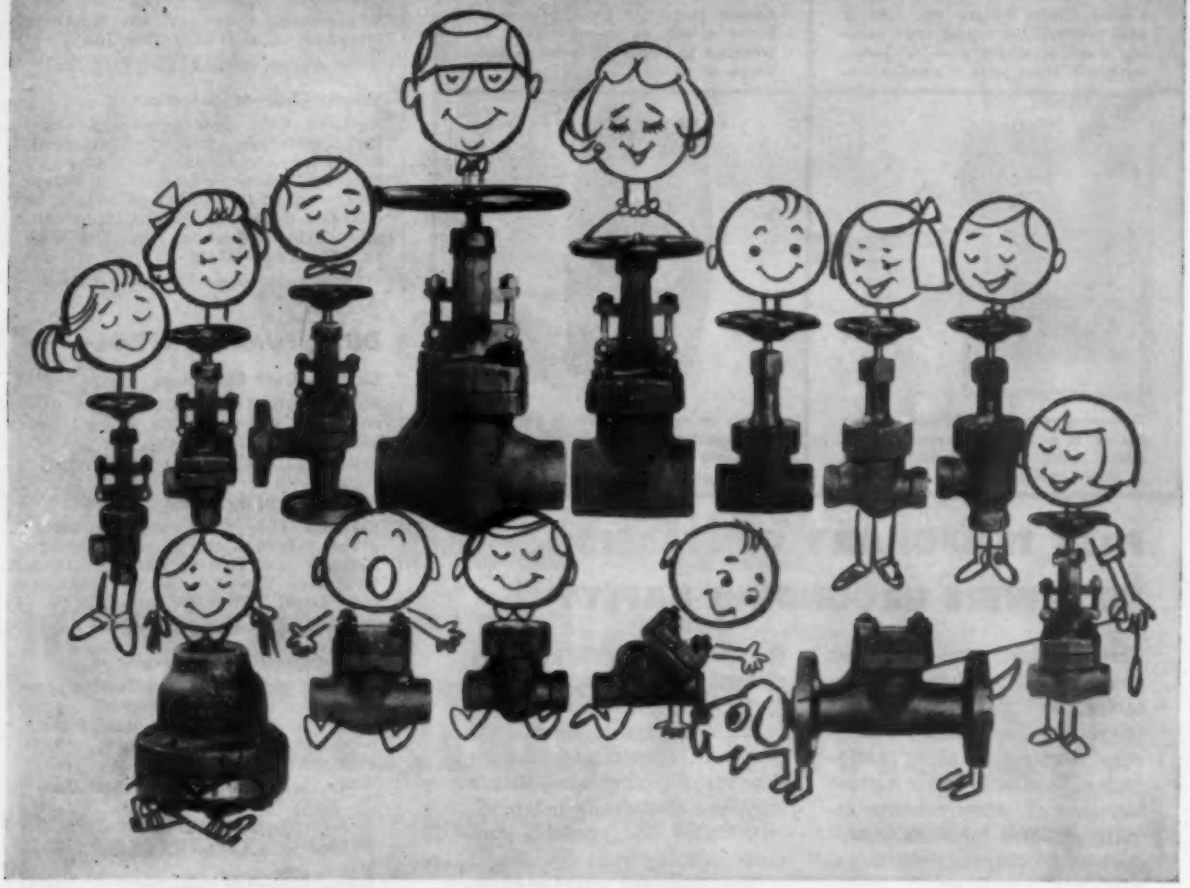
National Electrical Code articles pertaining to selection of electrical equipment for use in hazardous locations are quoted in 60-pp Bulletin 2722. Condulets are illustrated and described, wiring information, included. Crouse-Hinds Co.

For a copy, circle 333 on Post Card

Pressure-Grip Terminals

Twist-Lock terminals designed to simplify and speed wiring and assure

CRANE'S LARGE FAMILY OF SMALL STEEL VALVES



CRANE 600-POUND STEEL GATE, GLOBE, ANGLE AND CHECK VALVES—¼" TO 2" SIZES—

gathered together for their first family portrait, from thousands of flow control assignments in every industry. In forged and cast steel; bolted and union bonnets and caps; outside screw and yoke or inside screw; Exelloy, Stellite*, Type 316 Stainless, Monel trims; reduced and full ports; screwed, flanged and socket-welding ends—one or more will meet every specific need. All share the Crane family trait of superior design, ruggedness and fine craftsmanship.

*Stellite is a registered trademark of Union Carbide Corp.

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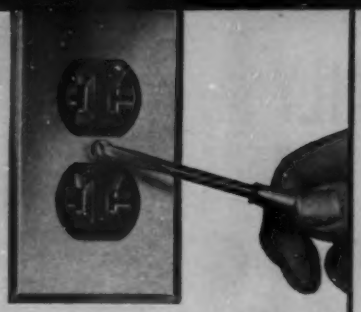
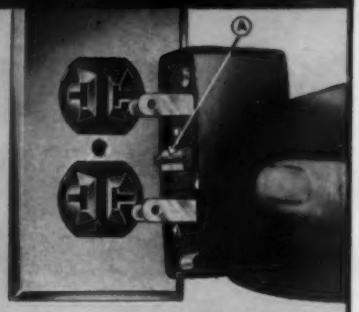
Circle 614 on postcard, page 33

HUBBELL DUPLEX ADAPTER

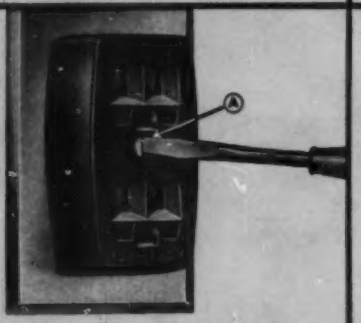
15 A., 125 V.



Hubbell Duplex Adapter No. 3291 is easy to attach. Just remove screw holding metal or plastic plate to 2-wire receptacle. Leave plate in place.



Adapter plugs into 2-wire receptacle. Screw A will go through plate to grounded box. It is connected to both U-slots of adapter.



Tightening Screw A establishes adapter ground in a grounded system. If the system is ungrounded, connect adapter as shown at right.

When an existing system is not properly grounded, the adapter may be grounded by connecting a grounded wire to green hex Screw B.

FAST TEMPORARY CONVERSION TO 3-WIRE GROUNDING SAFETY

This polarized, plug-in adapter converts 2-wire duplex receptacles used with grounded or ungrounded systems to temporary 3-wire grounding receptacles. Landlords find it a great convenience when tenants requiring 3-wire facilities cannot postpone occupancy until rewiring is completed.

To make a conversion, nothing in the existing system has to be removed except receptacle cover-plate screws, to make room for a captive screw in each adapter. This captive screw acts as a conductor from the two U-slots to the grounded system. For use with receptacles in ungrounded systems, there is a green binding screw to permit connection of an independent ground wire. Either way, the electrically independent blades and contacts continue existing split circuits.

The polarized adapter operates in any parallel or T-slot duplex receptacle with metal or plastic cover plates. Brown or ivorine bakelite, for 15 amperes, 125 volts. Size: 1.4" from plate, 3.3" high, 1.75" wide.

HARVEY HUBBELL INCORPORATED

Bridgeport 2, Connecticut

In Canada: Scarborough, Ontario

Circle 615 on postcard, page 33

DATA FILE

(Begins on page 204)

safety are illustrated in Catalog 3323. Harvey Hubbell, Inc.

For a copy, circle 334 on Post Card

Data on Electrical Equipment

Conduit bodies and fittings, connectors, ground fittings, EMT fittings and other electrical products are detailed in 48-pp Catalog 9. Dimensional data and features are given. Gedney Electric Co.

For a copy, circle 335 on Post Card

Control Batteries

Features and advantages of batteries for control, switch-gear and auxiliary power are listed in Bulletin CP-540. Engineering data and specifications included. C & D Batteries, Inc.

For a copy, circle 336 on Post Card

Silicon Charger Selection

Bulletin 6258 incorporates a chart for determining proper silicon-rectifier charger to be used with stand-by batteries. Enables selection of charger according to number of cells to be charged, output amperage, input voltage. Exide Industrial Div., The Electric Storage Battery Co.

For a copy, circle 337 on Post Card

DUST, FUME CONTROL

Cabinet Dust Collectors

Self-contained cloth-filter type dust collectors are described in 6-pp Bulletin 359. Torit Mfg. Co.

For a copy, circle 339 on Post Card

Dust Control Systems

Bulletin 104, 36 p, on dust filters, gives information on dust control systems and how to engineer them. Describes the Roll-Clean Dynaclone dust filter. The W. W. Sly Mfg. Co.

For a copy, circle 340 on Post Card

Dust Collection, Recovery

Product data on dust collection, precipitation and gas scrubbing equipment covers electrical precipitators, mechanical dust collectors, others. Western Precipitation Corp.

For a copy, circle 341 on Post Card

PUMPS, COMPRESSORS

Pump Selection Catalog

Included in 12-pp, easy-to-use Circular 184 are charts showing temperature ranges from —350 to +1000 F, and pressures to 1000 psig for 10 classifications of pumps. Dean Brothers Pumps, Inc.

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Technical Data on Rotary Pumps

This selection manual on rotary pumps groups liquids according to viscosity. The Deming Co.

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For Free-Flowing to Solid Operation

Bulletin 30-C, 8-pp, outlines advantages of pumps which handle free-

emergency
maintenance fund for DEMING PUMPS

Special maintenance on your Deming pumps probably won't cost you a nickel! Years of trouble-free performance is the rule; emergencies rarely occur.

Dependable Demings save you money in other ways, too. When routine servicing is performed, spare parts inventory is light because Deming parts are standardized and readily interchangeable. Plant expansion costs less because Deming pumps are designed for adaptation to your growth requirements.

Deming rotary and sump pumps, end suction and vertical immersion process pumps are of special interest to the processing industries. For complete descriptive literature, just mail the coupon.

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748 Broadway • Salem, Ohio

Please send me catalogs on: (type)_____ pumps
for (application)_____
NAME_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

Circle 616 on postcard, page 33

about fans that move air in
either direction with equal efficiency...

HARTZELL REVERSIBLE FANS

Intake one minute, exhaust the next, with the same fan. You can do it with the unique Hartzell reversible fan — making one unit do the work of two with air moving efficiency that is seldom achieved with a conventional one-way fan. Hartzell reversible fans are ideal for many special ventilating jobs and for a wide variety of cooling and drying applications. Sizes from 18" to 42", in ring or duct section mounting or in a special roof ventilator housing. Here's more proof that Hartzell has the equipment, and the engineering "know-how", to help you solve your unusual air moving problems.

For complete details, just give your nearby Hartzell field engineer a call. You'll find him listed in the Yellow Pages or in the Hartzell catalog in Sweet's Plant Engineering and Industrial Construction Files.

Hartzell PROPELLER FAN COMPANY
Division of Castle Hills Corp. • PIQUA, OHIO
(HARTZELL)
A Member of AMCA

Circle 617 on postcard, page 33

DATA FILE

(Begins on page 204)

flowing liquids to nonpourable pastes and abrasive solids. Describes operation. Robbins & Myers, Inc.

For a copy, circle 344 on Post Card

Water-Cooled Compressors

Described in Bulletin LA-1 are the LA and LB water-cooled compressors, the LA for operation at normal plant pressures and the LB for high pressure use. Gardner-Denver Co.

For a copy, circle 345 on Post Card

Semi-Radial Air Compressors

Design and construction details on semi-radial air compressors and their advantages are presented in 24-pp Bulletin A-72. Joy Mfg. Co.

For a copy, circle 346 on Post Card

Compressors for Industrial Use

Design features and applications of unit type to 15 hp and stationary type to 100 hp compressors are detailed in this bulletin. Le Roi Div., Westinghouse Air Brake Co.

For a copy, circle 347 on Post Card

PACKINGS, SEALS

Compression Packings

Featured in this 22-pp catalog are compression packings, including sheet and rod seal types, packing materials, and list of packings for various services. E. F. Houghton & Co.

For a copy, circle 348 on Post Card

External Mechanical Seal

Bulletin CP-551 features a mechanical seal designed for complete interchangeability with packing in stuffing boxes of pumps and other rotating processing equipment. Chemical and Power Products, Inc.

For a copy, circle 349 on Post Card

Industrial Mechanical Seals

Performance and design features of Mechanipak PK mechanical seals for a variety of operating conditions are detailed in 8-pp Bulletin AD-150. Garlock, Inc.

For a copy, circle 350 on Post Card

LIGHTING

Modern Lighting Needs

"Footcandles in Modern Lighting" is a 20-pp booklet giving lighting level recommendations for seeing tasks involved in many activities. Figures based on findings of Illuminating Engineering Research Institute and Illuminating Engineering Society. General Electric Co.

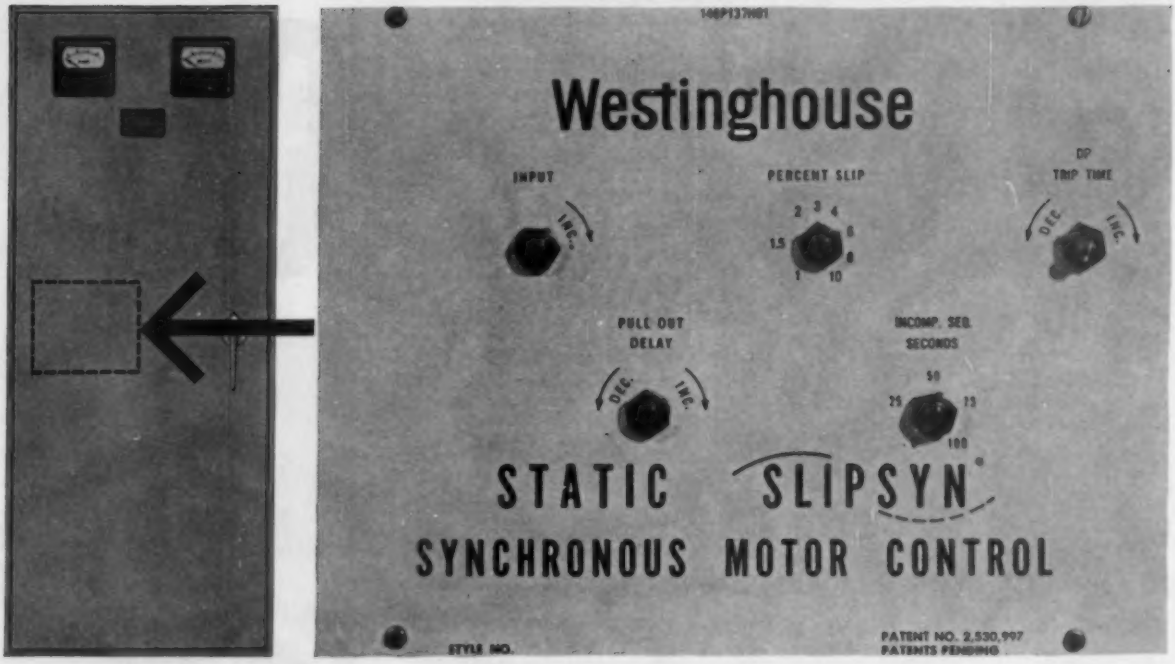
For a copy, circle 352 on Post Card

Lamp Selection Data

Incandescent and fluorescent lamps are described in Form 2B with selection tables, electrical details and price list. Champion Lamp Works.

For a copy, circle 353 on Post Card

Now... Westinghouse Static Slipsyn* Control includes 3 more static protective features for synchronous motors



1. **STATIC DAMPER WINDING NETWORK** protects synchronous motors against damage by locked rotor or excessively-long starting conditions. This circuit may be quickly and easily added to your present static units.

2. **STATIC FIELD LOSS NETWORK** protects motors against abnormal conditions resulting from loss of d-c excitation.

3. **STATIC INCOMPLETE SEQUENCE NETWORK** protects the motor in case it fails to sequence properly during start up.

These features, added to the basic Westinghouse exclusive Static Slipsyn control make Static Slipsyn more than ever, the best control available. Its advantages:

Most accurate synchronization system available—accuracy up to 99% of synchronous speeds — not affected by machine vibrations.

Adjustable pull-out protection—eliminates nuisance tripping due to transient conditions — easily adjusts from the front — can be set to re-synchronize or shutdown on actual pullout.

No maintenance — completely static transistorized synchronizing system — uses no moving parts — components are impervious to humid, corrosive or dirty atmospheres — there are no relays to burn, pit, inspect or repair.

Applicable to all synchronous motor starters—same sized package for all applications — for both high and low voltage — whether for new motor installation or for relay replacement.

For additional information on the advantages of Static Slipsyn Control for synchronous motors in *all* manufacturing operations, call your local Westinghouse sales engineer or write to: Westinghouse Electric Corporation, General Purpose Control Department, P.O. Box 2025, Buffalo 5, New York.

You can be sure ... if it's **Westinghouse**

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J-25011

Circle 618 on postcard, page 33

This Hopper on your truck

CAN CUT HANDLING COSTS 50%

Here's the fastest, lowest cost method of handling bulk materials and small parts—hot or cold, wet or dry.

One man with a Roura Hopper can do the work of two and do it in half the time. Loaded Hopper is picked up by the truck operator in a matter of seconds. Platform or forks slip into underframe and it can't slip off.

DUMPS ITSELF

Loaded Hopper is transported to its destination—operator trips the latch—and the Hopper automatically dumps its load, rights itself, locks itself.

RIGHTS ITSELF

Thousands of Roura Hoppers are now in use handling scrap metal, hot forgings and castings, cinders and aggregate, pickles—and dozens of other items.

LOCKS ITSELF

They're made in eight sizes, ⅓ to 4 yards capacity. Built of ⅜" steel plate with continuous arc-welded seams. Heavier plate if desired, also stainless steel or galvanized. Mounted on live skids or with a choice of wheels. Can ship standard models immediately.

ROURA
Self-Dumping
HOPPER

ASK FOR BOOKLET. Just clip this coupon to your letterhead and mail. We'll send illustrated literature. No obligation.

ROURA IRON WORKS, INC.
Woodland Ave., Detroit 11, Michigan

Circle 619 on postcard, page 33

DATA FILE

(Begins on page 204)

New Light, More Light

Fluorescent lights designed to offer most light for the money are featured in this product bulletin. Includes eye sensitivity curve, comparative output chart. Westinghouse Electric Corp.

For a copy, circle 354 on Post Card

High-Bay Lighting

Characteristics and advantages of mercury vapor and incandescent high-bay lighting and types of reflectors available are detailed in 20-pp Bulletin H. Application data and coefficients of utilization. Benjamin Div., Thomas Industries Inc.

For a copy, circle 355 on Post Card

Industrial Fixtures

This 1961 Catalog, 24-pp, describes lighting fixtures for commercial and industrial applications. Selection tables, industrial hangers and accessories. Day-Brite Lighting, Inc.

For a copy, circle 356 on Post Card

Improved Emergency Lighting

Battery-operated emergency lighting fixture, designed to operate instantly in event of power failure, are described in this 8-pp catalog. Gives operating data, prices, layout and installation information. Electric Cord Co.

For a copy, circle 357 on Post Card

LUBRICATION

Organized Lubrication Benefits

Major cost control factors of organized lubrication are told in this 24-pp bulletin. Covers cost control opportunities, assigning responsibilities. Texaco, Inc.

For a copy, circle 358 on Post Card

Multi-Purpose Greases

Information on six Litholine greases is presented in this product bulletin, giving advantages offered. Sinclair Refining Co.

For a copy, circle 359 on Post Card

Heavy Duty Soluble Oil

Oil for use on tough cutting and grinding operations is described in Booklet SP-9089. Advantages are listed. Gulf Oil Corp.

For a copy, circle 360 on Post Card

Guns for Lube Cartridges

Bulletin 732 describes lever guns designed to handle lube cartridges and to dispense bulk grease. Three-way reloading is detailed. Lincoln Engineering Co.

For a copy, circle 361 on Post Card

TOOLS, WELDING AND MACHINE SHOP

Industrial Wrenches, Hand Tools

Over 4000 items for production and maintenance are presented in 180-pp

EASY TO CUT

REYNOLDS ALUMINUM RIGID CONDUIT

★ Lightweight
★ Easy to Thread
★ Easy to Handle
★ Easy to Bend
★ Less Voltage Drop
★ Locally Stocked

For complete information and names of Reynolds Aluminum Rigid Conduit Distributors, call your Reynolds Sales Office, or write: *Reynolds Metals Company, Box 2346-EQ, Richmond 18, Virginia.*

Circle 620 on postcard, page 33

Oakland Auditorium, Oakland, California. Interior by Division of Architecture, City of Oakland Department of Public Works.

Looking for something new in panels?

YOU'VE FOUND IT. These translucent divider panels have textiles, weaves, wood, and even metal molded right into them. They give you almost unlimited choice of decorative design and color.

You can get them for exteriors or interiors. They're light in weight, rugged, and won't shatter because they are made of plastic and fibrous glass. They're resistant to solvents, easy to install and maintain.

The panels softly diffuse natural and artificial light. Choice of designs transmitting from 17% to 87% of natural or artificial light, as well as choice of thickness, helps you solve lighting and thermal control problems.

SELF-EXTINGUISHING FOR CODES. This paneling comes in a special grade that doesn't support combustion.

It's designed to meet safety codes for offices, schools, plants, hospitals. Made with Hetron®, the flame-retardant polyester plastic.

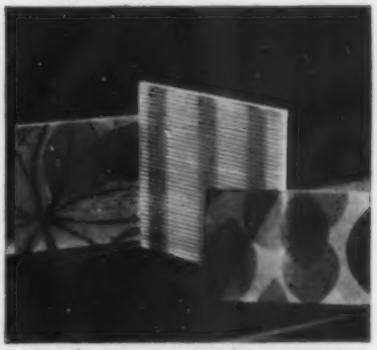
Panels containing this plastic are different. Even if flame gets a foothold, it doesn't spread.

That's why, when codes say "fire-retardant material," it's a good idea to write "Hetron" in your panel specification.

Then you're sure.

You can get a wide choice of daylighting and interior panels, corrugated or flat, made with this self-extinguishing plastic by leading fabricators in this country and Canada.

Write, and we'll be glad to tell you who they are.



Attractive, sturdy—and safe—paneling shown above incorporates many designs. It is made with Hetron fire-retardant plastic by Panelcraft Company, San Francisco.

DUREZ PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION, 3907 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICALS PLASTICS

Circle 621 on postcard, page 33

DATA FILE

(Begins on page 204)

Catalog 60-1, including sockets and shanks for use on impact and nut setting wrenches, standard wrenches and tools, shop equipment, hydraulic pullers, electric drills, grinders, sanders, etc. Snap-On Tools Corp.

For a copy, circle 363 on Post Card

Hand Tools, Sets, Chests

Illustrated and described in 16-pp Catalog H-9 are wrenches, pliers, cutters, screw drivers, punches, chisels, sockets, handles, extensions, socket sets, tool sets, tool chests, other tools. Owatonna Tool Co.

For a copy, circle 364 on Post Card

Pipe Tool Guide

Application data on Rigid pipe tools is provided in 16-pp Catalog 7596R-6. Wrenches, cutters, threaders, reamers, vises and others are illustrated. The Ridge Tool Co.

For a copy, circle 365 on Post Card

Industrial Power Tools

Data on power tools for construction, production and maintenance are presented in 38-pp Form 85. Covers drills, hole saws, magnetic drill presses, screwdrivers and accessories, impact wrenches, belt sanders, grinders, grinding wheels, saw blades. Black & Decker Mfg. Co.

For a copy, circle 366 on Post Card

Guide to Power Tools

Presented in this 68-pp catalog are electric and pneumatic tools for production, maintenance, construction, wood and metal working. Features worm drive and high speed saws; reciprocating saws; jig saws; hammers; planes, routers; sanders; drills; drivers; wrenches. Skil Corp.

For a copy, circle 367 on Post Card

Fastening Tool

Illustrated in Catalog Form B-141 is the Duo-Jobmaster for tough fastening jobs into steel or concrete. Features, advantages detailed. Ramset Div., Olin Mathieson Chemical Corp.

For a copy, circle 368 on Post Card

Any of these bulletins, catalogs and technical booklets can be yours without cost or obligation. Use the Reader Service Cards on page 34.

Welding Wire Applications

Submerged arc and inert gas welding wires are discussed in Bulletin DH-402-C. Stainless steel, low alloy and mild carbon steel automatic welding wire applications described. Page Steel & Wire Div., American Chain & Cable Co., Inc.

For a copy, circle 369 on Post Card

Flame Spraying Processes

Basic engineering and application data on flame-sprayed coatings of metals, ceramics, carbides and other high-melting-point materials are presented in 16-pp Bulletin 136B. Includes charts on specific characteristics. Metco, Inc.

For a copy, circle 370 on Post Card

MECHANICAL POWER TRANSMISSION

Adjustable Speed Fluid Drives

Bulletin 9819, 8 pp, describes adjustable speed Gyrol fluid drives, 1- to 25-hp, giving advantages, applications, components and operation. Industrial Div., American-Standard.

For a copy, cricle 371 on Post Card

Cast Iron and Steel Gears

Selection data for cut tooth and cast tooth spur, bevel and miter gears and pinions is presented in 66-pp Catalog 1-D. Includes horsepower tables, dimensions, prices. The J. B. Ehrsam and Sons Mfg. Co.

For a copy, circle 372 on Post Card

Standard Spring Clutches

Described in this 30-pp catalog are five lines of spring clutches in bore sizes from ⅛ to 1 in., torque capacity to 1250 lb-in. for applications utilizing drive up to 5 hp. Clutches include over-running and back-stopping; indexing; on-off; on-off indexing; and safety lock control. Marquette Div., Curtiss-Wright Corp.

For a copy, circle 373 on Post Card

CONTROL

New! Cutler-Hammer Size 00 A-C Magnetic Starter... 20% smaller...18% less cost

Now save space and money with the all new Cutler-Hammer Ac-Magnetic Starter. The new Size 00 fits about 40% of the applications where the Size 0 is now used. You still get the famous Three Star line quality—same high reliability—famous vertical, dust-free silver contacts. Max. hp ratings: 3 phase: 208/220V., 1½ h.p. 440/550V., 2 h.p. Single phase: 115V., ½ h.p. 230V., 1 h.p. Get it open or in NEMA 1 enclosure. Send for Pub. LO-40-N274.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer, Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer, Mexicana, S. A.

Circle 622 on postacrd, page 33

Circle 623 on postcard, page 33→

Here's why power roof ventilators satisfy so many

Pinpointing Patented Pressure Cooling. Ilg-built backward curved aluminum airfoil fan wheel with patented backplate fins pulls cool air into motor compartment and *through the motor* to protect against build-up of heat from sun . . . *increases motor life expectancy up to four times that of ordinary units.* Fifteen sizes to choose from for capacities from 155 to 27,290 cfm. WRITE FOR CATALOG DB3-200.

Upblast Roof Ventilators with butterfly dampers provide high-speed, vertical exhaust. Airfoil-design propeller blades (in five sizes from 24" to 48") are direct-connected to Ilg-built totally enclosed motors. A choice of five sizes for capacities from 5060 to 33,300 cfm. WRITE FOR CATALOG DB3-300.

Low in Height . . . High in Performance. Ilg L-LSQ propeller fan power roof ventilators feature direct-connected, patented "Q" fan wheels that pass air over blade smoothly, quietly. Low starting torque of Ilg 3-phase and permanent-split capacitor, single-phase motors eliminates starting shock, lengthens fan life. Eleven sizes to choose from for capacity range of 287 to 26,500 cfm—at pressures from 0" to ⅛". WRITE FOR CATALOG DB3-100.

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DATA FILE

(Begins on page 204)

Cast-Tooth Sprockets

Stock sizes of cast-tooth sprockets are listed in Book 2867, 12-pp. Arm center, plate center, segmental, and split rim sprockets and traction wheels are included. Link-Belt Co.

For a copy, circle 374 on Post Card

Heavy-Duty Couplings

Catalog 70, 12 pp, contains engineering and application data on dihedral spindle shaft couplings for mills and allied equipment for metal, paper, rubber, chemical, food industries. Ajax Flexible Coupling Co., Inc.

For a copy, circle 375 on Post Card

VALVES, TRAPS, PIPING AND FITTINGS

Stainless Steel Valves

Catalog 59SS, 32 pp, on stainless steel valves, illustrates design and construction features. Details advantages in withstanding corrosive atmospheres. Jenkins Bros.

For a copy, circle 376 on Post Card

Air Control Products

Described in 16-pp bulletin Form A-320 are air cylinders and air control valves, including solenoid and manual valves for a variety of applications. A. Schrader's Son.

For a copy, circle 377 on Post Card

Steam Traps, Regulators

This 12-pp condensed catalog contains technical and capacity data on steam traps, temperature regulators and heating specialties. Cutaway views included. Sarco Co., Inc.

For a copy, circle 378 on Post Card

Manual on Steam Traps

Catalog K, 48 pp, on steam traps, provides information on open flat and thermostatic types, pipe strainers. Discusses fundamentals of steam trapping, selection, installation; includes steam pipe sizing tables. Armstrong Machine Works.

For a copy, circle 379 on Post Card

Plumbing and Heating Supplies

Technical details, dimension and capacity data on steam traps, temperature regulators and heating specialties are contained in this 12-pp 1960 Catalog with cutaway views and diagrams included. Sarco Co., Inc.

For a copy, circle 380 on Post Card

Unions, Valves, Fittings

Ring-bound Catalog U-601 provides detailed literature on unions, valves and fittings of forged steel. Lists popular unions with their technical ratings, details of construction. Clayton Mark & Co.

For a copy, circle 381 on Post Card

Copper Tubing Hangers

Selection and ordering data on copper tubing hangers is presented in 10-pp Catalog cth-56, covering loads, dimensions, weights and packaging. Grinnell Co., Inc.

For a copy, circle 382 on Post Card

Quick-Connective Couplings

Catalog 100 contains data sheets detailing quick-connective fluid-line couplings for pneumatic, hydraulic, oxygen, acetylene, steam gases and liquids service. Includes dimensions. The Hansen Mfg. Co.

For a copy, circle 383 on Post Card

INSULATION

Calcium Silicate Insulation

Pipe and block insulation of calcium silicate is featured in Form 6472. Lists heat transmission data, physical and thermal characteristics. Philip Carey Mfg. Co.

For a copy, circle 384 on Post Card

Thermal, Acoustical Duct Insulation

Textile-type glass fiber insulation for ducts is discussed in 8-pp Bulletin ULD-859. Characteristics, thermal efficiencies and sound absorption data is included. Gustin-Bacon Mfg. Co.

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Acoustical Insulation for Ducts

Described in Product Bulletin F-190 is a fiber glass insulation for keeping duct systems quiet. Advantages are detailed. Pittsburgh Plate Glass Co.

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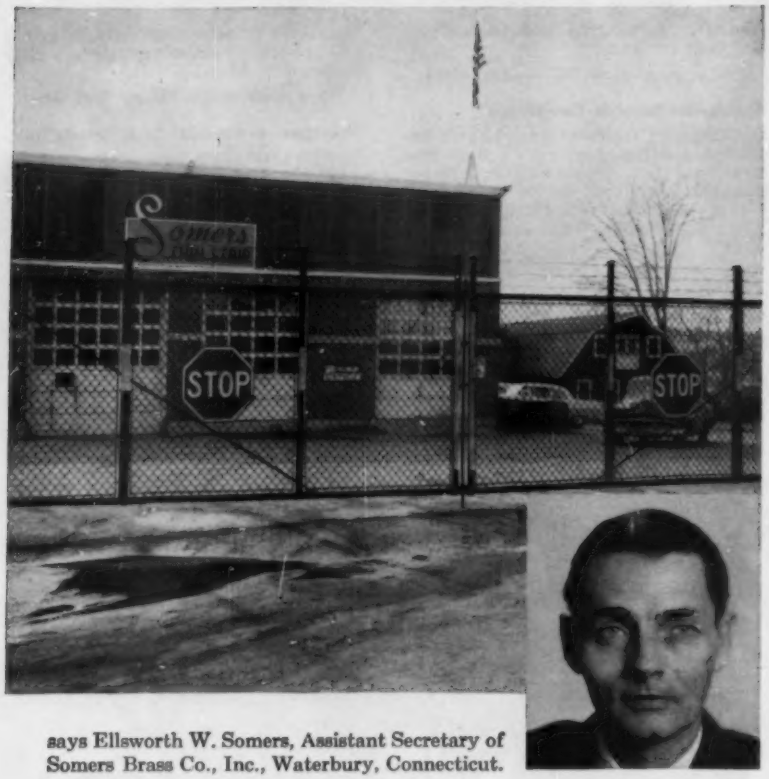
Circle 624 on postcard, page 33



says Ellsworth W. Somers, Assistant Secretary of Somers Brass Co., Inc., Waterbury, Connecticut.

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Circle 625 on postcard, page 33

DATA FILE

(Begins on page 204)

BOILERS, GENERATORS

Packaged Steam Generator

Design and construction details and tables of capacities, dimensions and weights on a compact, portable shop-assembled water tube boiler with integrated firing equipment and controls are presented in 10-pp Bulletin PSG-3. Henry Vogt Machine Co.

For a copy, circle 387 on Post Card

For Economical Operation

Automatic boilers (with the two-pass design) are discussed in Form BE-400. Boilers covered include 20 to 600 hp steam, hot water and HWT boilers. Continental Boiler Div., Boiler Engineering & Supply Co., Inc.

For a copy, circle 388 on Post Card

Controlled Steam Generation

Benefits of a totally controlled method of steam generation are explained in 14-pp Product Bulletin 1018. Includes a table of specifications. Clayton Mfg. Co.

For a copy, circle 389 on Post Card

For Low Fuel Consumption

Advantages of gas and combination burners for industrial and other use are detailed in Bulletin 5. Industrial Combustion, Inc.

For a copy, circle 390 on Post Card

SAFETY, SANITATION

Fire-Resistant Fluids

This series of specification sheets on fire-resistant fluids covers synthetics, oil-in-water and water-in-oil emulsions, glycols. Mobil Oil Co., Inc.

For a copy, circle 391 on Post Card

Handbook on Flammable Liquids

Problems involved in use of flammables in individual processes, with methods and equipment required for safe control, are contained in this 76-pp safety handbook. Properties and characteristics of common flammables detailed. The Protectoseal Co.

For a copy, circle 392 on Post Card

Alarm Systems for Buildings

Publication 246 contains 36-pp of information on fire alarm systems for applications in industrial and other buildings. Job specifications and accessory equipment included. The Standard Electric Time Co.

For a copy, circle 393 on Post Card

Signs for Industrial Safety

Catalog 11, 66-pp, illustrates signs for industrial accident prevention—danger, caution, directional, information and safety instruction signs. Prices given. Stonehouse Signs Inc.

For a copy, circle 394 on Post Card

Signals for Specific Operations

Tips on suitable signals for specific uses are offered in Bulletin 100.

Horn, bells, warning lights and other equipment are described with wiring diagrams and audibility rating charts. Federal Sign & Signal Corp.

For a copy, circle 395 on Post Card

CONSTRUCTION

Prestressed Concrete Strand

Folder W-202 Rev. outlines complete ASTM A-416-57T specification for seven-wire uncoated stress-relieved strand. Also contains load elongation curves on measurement of prestressing force. The Colorado Fuel and Iron Corp.

For a copy, circle 396 on Post Card

Concrete Admixtures

This 32-pp bulletin is a guide to concrete admixtures, iron-armoured floor products, grouting and waterproofing materials and other products for improving concrete and mortar. Contains guide specifications. The Master Builders Co.

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Steel Joist Construction

Standard and long span open web steel joists are illustrated in this 38-pp catalog. Advantages, design and properties of the construction are detailed. American Bridge Div., United States Steel Corp.

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Rolling Steel Doors

Details on rolling steel doors, grilles and shutters are presented in 16-pp Catalog G-61. Includes specifications, installation diagrams, tables of clearances. The R. C. Mahon Co.

For a copy, circle 399 on Post Card

Building with Steel

Twelve-pp Catalog B-16359 lists types of building constructions and gives dimensional data. Armco Drainage & Metal Products, Inc.

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Cold Storage Doors

Advantages of Electroglide electric horizontal sliding doors for cooler and freezer operation are detailed in this 6-pp bulletin. Includes table of sizes, installation data. Jamison Cold Storage Door Co.

For a copy, circle 401 on Post Card

Translucent Reglazing Panels

A fiber glass panel designed for replacement of shattered and fractured panes of wire glass is described in this product sheet. Butler Mfg. Co.

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Basic-Roofing Information

"What You Should Know About Your Roof" is a 40-pp booklet telling what makes a roof fail, how to recognize roof deterioration and what to do to keep a roof in good condition. Johns-Manville Corp.

For a copy, circle 403 on Post Card

Safety Grating for Industry

Steel, aluminum and stainless steel grating is featured in Catalog 5911, 24-pp. Shows installations and erection. The Globe Co.

For a copy, circle 404 on Post Card

Non-Slip Steel Flooring

Algrip, an abrasive rolled steel floor plate described as non-slip even on steep inclines, is the subject of 8-pp Booklet AL-29. Alan Wood Steel Co.

For a copy, circle 405 on Post Card

Safety Floor Plate

Advantages of Multigrip floor plate designed for sure footing and positive traction are detailed in Bulletin ADUCO-17002. Tables list sizes, thicknesses, weights and loads. U. S. Steel Corp.

For a copy, circle 406 on Post Card

Screw Fastening of Aluminum

This 48-pp technical handbook covers standard and special fasteners and fastening systems used to join aluminum assemblies. Includes list of manufacturers of screw fasteners. Reynolds Metals Co.

For a copy, circle 407 on Post Card

WATER CONDITIONING

Industrial Water Service

Discussed in this 22-pp bulletin is the range of industrial water problems—from pre-treatment to waste disposal—and need for proper water management to obtain lowest water costs. Hall Laboratories, Div. Hagan Chemicals & Controls, Inc.

For a copy, circle 408 on Post Card

Consulting Service

Advantages of company's consulting service in solving problems of scale and corrosion control in boilers, cooling systems, and process waters are detailed in Bulletin 5006-A. Dearborn Chemical Co.

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Feedwater Treatment

Bulletin B1 discusses advantages of direct treatment as a complete treating program or as a supplement to external systems. Nalco.

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Cooling Water Treatment

Chemical treatment of recirculating cooling water to prevent scale formation, corrosion and algae and slime contamination is discussed in this bulletin. Western Chemical Co.

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INSTRUMENTS, CONTROLS

Automatic Controls for Industry

Featured in this 92-pp catalog are automatic controls for commercial, industrial or processing plants. Specifications, diagrams, application data on electro-hydraulic valves and actuators, electric valve operators, air-operated proportioning valves included. General Controls Co.

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Centralized Control Systems

Development of centralized controls for air conditioning, heating and ventilating systems from early thermostat switchboards, remote bulb thermostats, converter and refrigeration controls to the pneumatic control

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Circle 626 on postcard, page 33

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Lists trouble symptoms and remedies on easy-to-use chart.

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Ask your General Electric distributor for the new G-E Maintenance Guide for Fluorescent Lighting, or write General Electric Company, Wiring Device Dept., Providence 7, R.I.

GENERAL ELECTRIC

Circle 627 on postcard, page 33

DATA FILE

(Begins on page 204)

center is illustrated in 12-pp Publication 2005. Johnson Service Co.

For a copy, circle 414 on Post Card

Indicator For Level-Control

Material-level indicators for controlling level of pulverized, fine, crushed or granular material in bin or silo are presented in Bulletin 1-5C, 8-pp. Fuller Co.

For a copy, circle 415 on Post Card

Pneumatic Transmitting Rotameters

Details on transmitters for communicating rotameter-measured fluid rates of flow to remote-located indicators, recorders, controllers or integrators are presented in Bulletin 18N. Schutte and Koerting Co.

For a copy, circle 416 on Post Card

Heat and Moisture Controls

Methods and apparatus for maintaining precise air temperature and moisture control for production operations and materials sensitive to changes in atmosphere are described in 8-pp Bulletin 122 on company's Type A air conditioner. Niagara Blower Co.

For a copy, circle 417 on Post Card

For On-Stream Analysis

Details on the Chemonitor, an instrument for continuous on-stream analysis of critical constituents in water, are presented in this 16-pp brochure. Hagan Chemicals & Controls, Inc.

For a copy, circle 418 on Post Card

HOSE

Industrial Hose Selector

Printed on heavy stock, Selector Guide IH-95 for industrial hose, can be hung on the wall for easy reference. The Gates Rubber Co.

For a copy, circle 419 on Post Card

Flexible Metal Hose, Tubing

Comprehensive selection data and specifications on flexible metal hose and tubing are presented in 60-pp Catalog G-601R. Typical applications are illustrated. Anaconda American Brass Co.

For a copy, circle 420 on Post Card

Reader Service Cards for ordering catalogs are on pages 33 and 34.

All-Purpose Hose

Bulletin A-5157K describes and lists advantages of hose suitable for air, oil, gasoline, chemicals and water. Goodyear Tire & Rubber Co.

For a copy, circle 421 on Post Card

Flexible Metal Hose, Couplings

Catalog 188, 8-pp, describes flexible metal, rubber and synthetic hose, expansion joints, and compensators. Applications, specifications included. Flexonics Corp.

For a copy, circle 422 on Post Card

HEATING, VENTILATING

Electric Heating Units

How to solve winter problems with electric heat is told in 16-pp Bulletin F-1575A. Job applications are illustrated. Edwin L. Wiegand Co.

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Hot Water for Industrial Plants

Cost-saving ideas on water heating installations, estimating hot water requirements for industrial and manufacturing use, sizing data and installation instructions are given in 100-pp Manual CH-110. Specifications, applications and water heater models provided. A. O. Smith Corp.

For a copy, circle 424 on Post Card

Heating, Ventilating Equipment

Propeller and centrifugal fans, power roof ventilators and unit heaters are described in Catalog DB7-102, 8-pp. Several new units are featured—Util-A-Sets, direct-drive and belted square panel propeller fans. Ilg Electric Ventilating Co.

For a copy, circle 425 on Post Card

Air Engineering Data File

Bulletin E-57, 24 pp, covers engineering and test facilities for propeller fans, specifications, construction, maintenance and installation

Be sure to see our family portrait on page 207

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Circle 628 on postcard, page 33

with tables for estimating air-handling. Aerovent Fan Co., Inc.

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Direct Connected Fans

Bulletin 690-A, 12 pp, gives dimensions, application and performance data on fans for general and system ventilation and power roof ventilators. Propellair Div., Robbins & Myers, Inc.

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Make-Up Air Solutions

Bulletin EN-5911 explains how air properly introduced eliminates problems arising when fans draw fumes, smoke or odors. Reznor Mfg. Co.

For a copy, circle 428 on Post Card

Air Handling Equipment

Product Bulletin B-5216 describes air handling, air cleaning, air conditioning and mechanical draft equipment, including heating and ventilating equipment, industrial process and mechanical draft apparatus, cooling and dehumidifying and electronic air cleaners. Westinghouse Electric Corp.

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Improved Air Filter

Micromat filters are detailed in this 12-pp product bulletin covering use in air conditioners, heating, ventilating. Describes basic types: two offering super resiliency and low water absorption; a panel type with locked-in filter insert; a universal cut-it-yourself filter; and a blanket form. Microton Corp.

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OTHER EQUIPMENT

Keys to Steel Satisfaction

Design, steel selection and heat treatment are described as the keys to optimum economy and material performance in this 77-pp manual of information on increasing endurance limit of steels. Climax Molybdenum Co., Div., American Metal Climax, Inc.

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Finishing Equipment

Contained in this file folder is a series of product bulletins on manual and automatic finishing equipment, including spray guns, nozzles, pumps, tanks, heaters, air compressors, regulators, hose. The De Vilbiss Co.

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Improved Sludge Solvent

Bulletin 594 describes a sludge solvent designed to eliminate difficulties encountered in the use and handling of residual fuel oils. Betz Laboratories, Inc.

For a copy, circle 433 on Post Card

Guide to Silicones

Engineering Guide 1-115, 12-pp, explains how various physical forms of silicones contribute to reliability, miniaturization, modularization and environmental protection, increase serviceability over wide extremes of temperature. Engineering data included. Dow Corning Corp.

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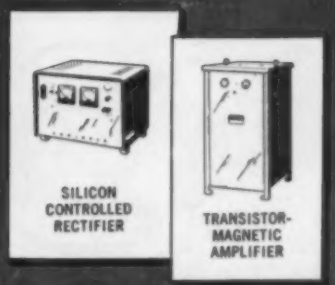

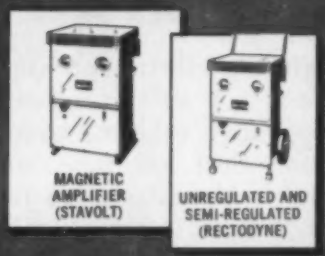

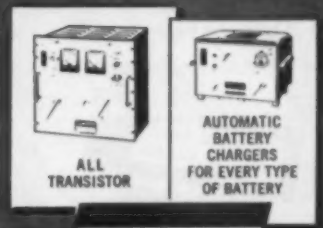

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about

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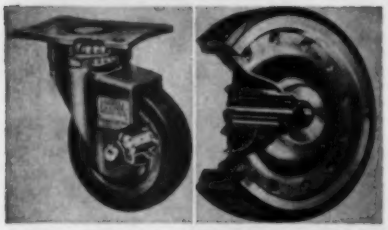

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Circle 630 on postcard, page 33

DATA FILE

(Begins on page 204)

Data on Nickel-Chromium Alloy

Technical Bulletin T-38, 36-pp, gives information on Inconel X, an age-hardenable nickel-chromium alloy. Physical and mechanical properties, applications, specifications, forms, design data and graphs are given. The International Nickel Co., Inc.

For a copy, circle 435 on Post Card

Two-Cycle Gas Engines

Discussed in Bulletin 205 are turbo-charged two-cycle gas engines with emphasis on their performance characteristics in variable-speed, variable-load applications. Clark Bros. Co.

For a copy, circle 436 on Post Card

Special Machines for Industry

Custom-engineered air and hydraulic operated machines for industrial operations are featured in Bulletin 7-A. Logansport Machine Co., Inc.

For a copy circle 437 on Post Card

Compressed Air Products Guide

Color-coded for product identification, Catalog 158, 24-pp, contains information on filters, regulators, lubricators, drains and accessories. Wilkerson Corp.

For a copy, circle 438 on Post Card

Blast Cleaning Methods, Equipment

Blast cleaning and finishing methods and equipment are provided in Bulletin 1230, 24-pp. Features blast cleaning barrels, tables, descaling machines, dust control equipment and abrasives. Pangborn Corp.

For a copy, circle 439 on Post Card

For Air Conditioning, Processing

Twenty-pp Catalog DS-435 features a hermetic, packaged absorption refrigeration machine which uses low pressure steam to produce chilled water for air conditioning and process applications. The TraneCo.

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Mechanical Press Brakes

Catalog 2023-B, 50-pp, covers features and new models of the Steelweld press line. Photos and drawings show available models; design features and typical installations with specifications for machines from 160 to 1250 tons are provided. The Cleveland Crane & Engineering Co.

For a copy, circle 441 on Post Card

Pneumatic Products for Industry

Catalog 1000, 64 pp, discusses benefits of proper compressed air processing. Describes compressed-air-line filters, pressure regulators, air-line lubricators, valves. Includes compressed air chart. C. A. Norgren Co.

For a copy, circle 442 on Post Card

Flame-Resistant Products

Structural panels, skylight louvers, chemical duct-work and other products of Hetron, a flame-resistant polyester resin, are covered in Bulletin D-6. Hooker Chemical Corp.

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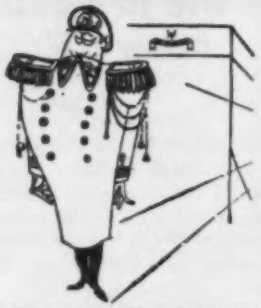
Circle 631 on postcard, page 33



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Production Management

MODERN PRODUCTION MANAGEMENT by E. S. Buffa, Ph.D. Size 9¼ by 6 in. approx; 636 pp including index; illustrated; cloth bound. Published by John Wiley & Sons, Inc., 440 Park Ave. So., New York 16, N. Y. Price $10.25.

THE AUTHOR has prepared a book with an updated approach on the subject of production management. Modern information has been blended with the traditional type.

Besides the principal introductory section, the book has three other main parts, namely: analytical methods in production management; design of production systems; and operation and control of production systems.

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Drawing and Geometry

ENGINEERING DRAWING AND GEOMETRY by R. P. Hoelscher and C. H. Springer. Size 10¼ by 8⅛ in.; over 650 pp; illustrated; cloth bound. Published by John Wiley & Sons, Inc., 440 Park Avenue, New York 16, N.Y. Price $8.95.

REVISIONS and new features appear in the second edition of the book authored by experienced educators and contributors to American drafting standards work. Theory and fundamentals of projection are stressed in this book which has over 1000 illustrations and many practice problems.

Following some basic information in the first part on such subjects as sketching, sectional views, and material specifications, the book continues with treatments of subjects in the following categories: geometry of advanced projection systems; technical charts and graphic computation; and professional applications.

Some of the items discussed in the three book divisions named above are: axonometric projection, oblique projection, graphic vector analysis, construction and use of nomographs, structural drawing, and patent office drawing.

The appendix section contains tabulated material which includes information on drill sizes, threads, fits, structural members, symbols, and mathematical functions.

Data Processing Systems

MANAGEMENT INFLUENCE ON THE DESIGN OF DATA PROCESSING SYSTEMS by Edward L. Wallace. Size 8⅛ by 5¼ in.; over 250 pp; paperbound. Published by Division of Research, Harvard Business School, Boston 63, Mass. Price $3.00.

THIS BOOK deals with problems associated with the incorporation of mechanical methods of handling data for a footware manufacturer. It is a case study probing into the administrative operations affecting the selection of a system. Details of two company approaches are examined and an al-

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NEW BOOKS

ternative method is presented by the author.

Among the many subjects commented upon in this study are the following: organization of planning divisions, production control, budgets, raw material planning and procurement, study group's evaluation of proposals, reassignment and retraining, advantages of the alternative system, and summary of features of the various control systems.

Welding Design

DESIGN OF WELDED STRUCTURAL CONNECTIONS by O. W. Blodgett and J. B. Scalzi. Size 11 by 8¾ approx; 96 pp; illustrated; simulated leather, spiral edge. Published by the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio. Price $1.00 in U.S.A.—$1.50 elsewhere.

WELDED connection design based on the elastic theory is covered extensively in one of the chapters in this informative manual; sample calculations are included. Design based on the plastic theory is also treated in another chapter of the manual. This section discusses the philosophy and limitations of the plastic theory in addition to listing the AISC rules for connections.

The shielded arc process is discussed briefly. A section on welding procedures contains numerous illustrations reproduced from drawings, showing the arrangements of pieces for welding and also welded joints. Numerous examples are included throughout the manual to emphasize a specific point which is discussed in that particular section.

It also contains information on welded design for bridgework, building and bridge erection, welding to structures built previously, and inspection. A bibliography is also included in the manual.

On Rare Metals

RARE METALS HANDBOOK edited by C. A. Hampel. Size 10¼ by 7¼ in. approx; over 700 pp; illustrated; clothbound. Published by Reinhold Publishing Corporation, 430 Park Ave., New York 22, N.Y. Price $20.00.

MATERIAL found in the first edition has been revised and updated for this edition which also has been expanded by new information. The handbook containing contributions from 44 individuals deals with many metals.

In the first chapter there are comments on sources of metals, unusual processing problems, natural occurrence, and available concentration of metals.

One of the other chapters contains a treatment of the metallic element, molybdenum. It deals briefly with the derivation of molybdenum through the powder metallurgy and arc-casting processes. The working of this element and fabrication is also discussed. Among other comments are those on applications.

The chapter on plutonium includes information on such items as thermal properties, electrical and magnetic properties, elastic properties, and toxicity and handling.

Comments on extractive metallurgy of titanium appear in a section on this metal. Among the tables appearing in this chapter is one on mechanical properties of commercial titanium alloys. Other items of discussion include the heat treatment of titanium alloys.

The following are some of the other metals treated in various chapters: columbium, indium, rubidium and cesium, tantulum, vanadium, and beryllium.

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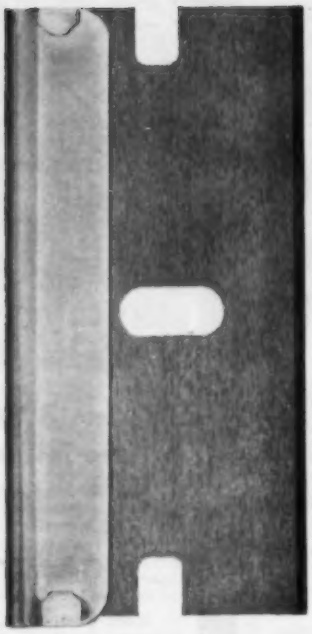

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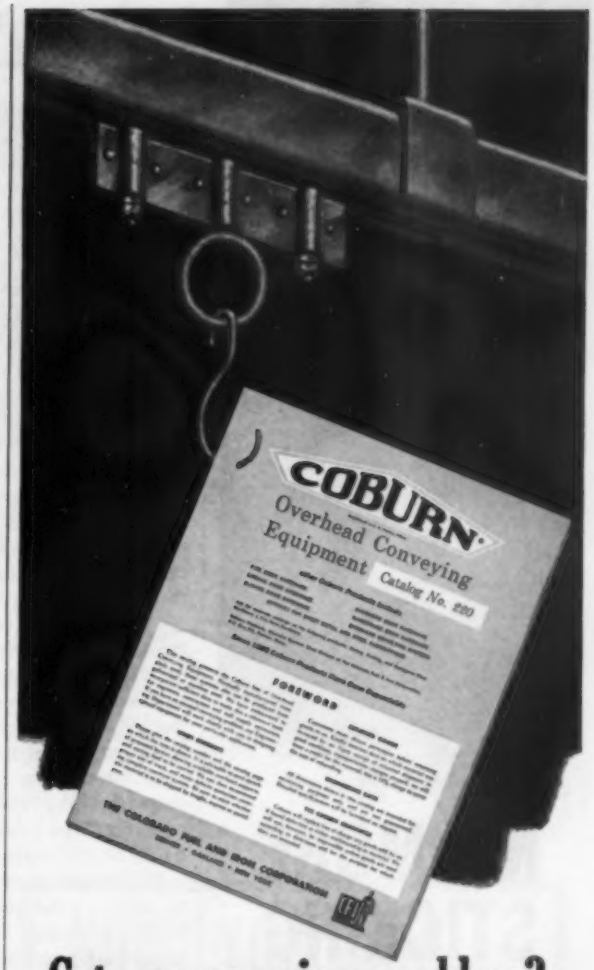

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Managing a PM Program

(Continued from page 94)

relating these items to production. In some cases, actual production costs may not be readily available to the PM group, or they may be disproportionately affected by factors other than maintenance, e.g. material variations, changing product specifications or fluctuating labor costs.

Where production costs cannot be used as reliable indicators of effective maintenance, there are usually numerous alternatives available. For example, the daily or weekly units produced, the total cost of machine downtime (in terms of machine-hour rates and lost time), scrap produced by faulty equipment, the safety record, and certain excess labor costs can often be used to measure the benefits of PM operations.

The PM supervisor should also try to establish several reliable ratios for use as quick spot checks on the effectiveness of his program. Typical weekly indicators might be; the units produced versus machine downtime, total production costs versus PM costs, machine downtime versus PM costs, and the relation of scrap produced to PM costs.

While the primary aim is, of course, to reduce total production costs, it is also necessary to control maintenance costs, and intelligent use of ratios will enable the real value of the PM program to be continuously monitored. The ratio of PM costs to total maintenance costs is another significant control figure.

An essential yardstick is the reference period. This is a period agreed by management as being representative of general conditions before the PM program went into operation, for which reliable operating and maintenance data are available. As the program progresses, comparisons of weekly achievements with reference period figures shown on a management posting sheet provide realistic evidence of the benefits achieved by sound preventive maintenance.

Collecting reference period data should be the first job undertaken when setting up a PM program, since this information may not be available at a later date. A camera can sometimes also be used to dramatize the before-and-after situations, and illustrate physical improvements such as cleaner and safer operating conditions, longer machine runs without

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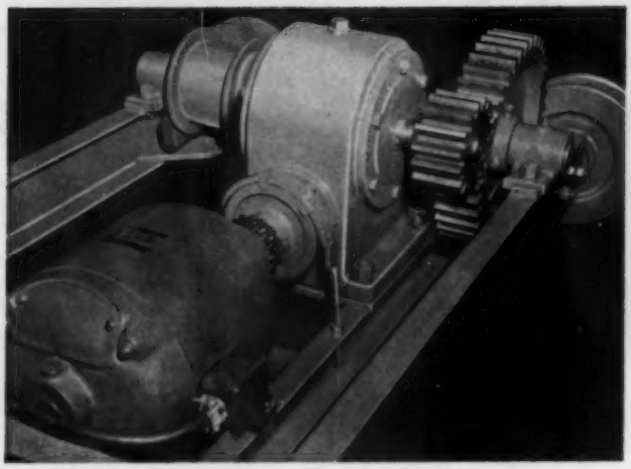

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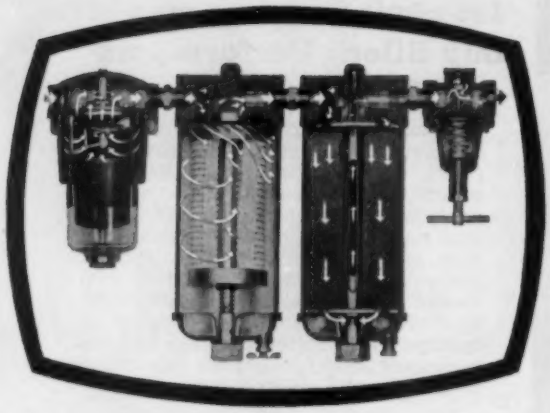

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As mentioned previously, the presentation to management of a weekly PM sheet which shows the actual costs and savings made (together with one or two significant figures and ratios) is an excellent way of demonstrating the value of PM. This value can usually be given a double emphasis by simultaneous comparison with less favorable reference period data, which should be shown on the weekly PM sheet, as in Fig. 3. Not infrequently, a reduction in overall maintenance costs can also be made; hence PM and maintenance costs should be kept separate and shown side by side for comparison.

Naturally, members of the PM group should be fully informed of the benefits resulting from their work. It should also be regularly demonstrated to production personnel, in order to insure plant-wide cooperation. After all, nothing succeeds like success. **End**

Storage Problem Solved

(Continued from page 108)

The height of the upright on the modified truck posed special stability problems which Clark's design engineers were able to solve. To prevent sway at extended lift heights, the lift truck has solid tires instead of cushion tires commonly used on trucks of this capacity. A non-pivoting steer axle also aids in stabilizing the truck.

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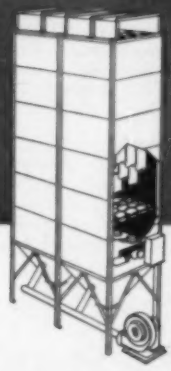

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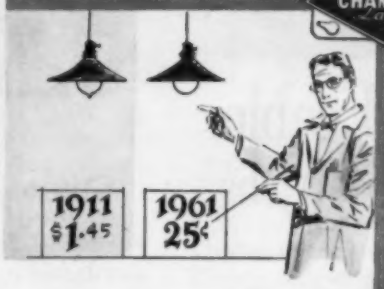

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OVER 200 INSPECTIONS GUARD CHAMPION LAMP QUALITY.

Your Best Buy in Lamps

CHAMPION LAMP WORKS, Lynn, Massachusetts
CHAMPION INCANDESCENT-FLUORESCENT
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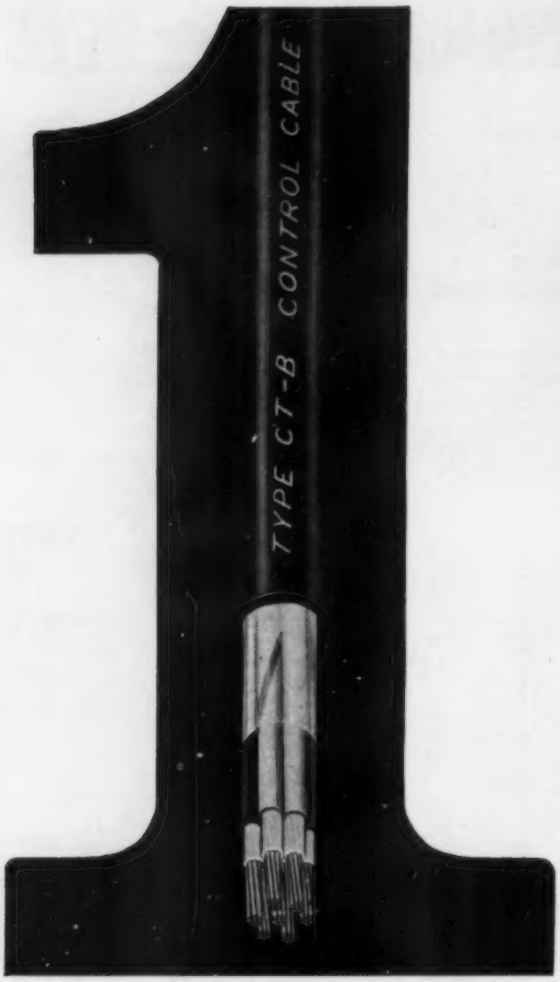

Use one standard cable for most multi-conductor jobs

You can now get quick delivery on *standard* control cable from Rome in any combination of:

- Type CT-B for AC or DC voltages to 600, or type CT-C for voltages to 1000. Both meet IPCEA-NEMA standards.
- 1 to 37 conductors
- No. 10 or No. 12 AWG stranded copper conductors

These CT cables are lighter, smaller, more flexible than standard rubber types. Each conductor is insulated with polyethylene for maximum dielectric capability, particularly where moisture, acids, alkalies or oils are problems.

The conductor and cable jackets are Synthinol (polyvinyl chloride), providing mechanical protection and added resistance to heat, flame, chemicals and corrosion.

Many sizes can be delivered off the shelf. A list of these, and all the facts and figures on this standard CT control cable, are contained in a 4-page booklet. For your copy, write to Rome Cable Division of Alcoa, Dept. 5-71, Rome, N. Y.

ALCOA
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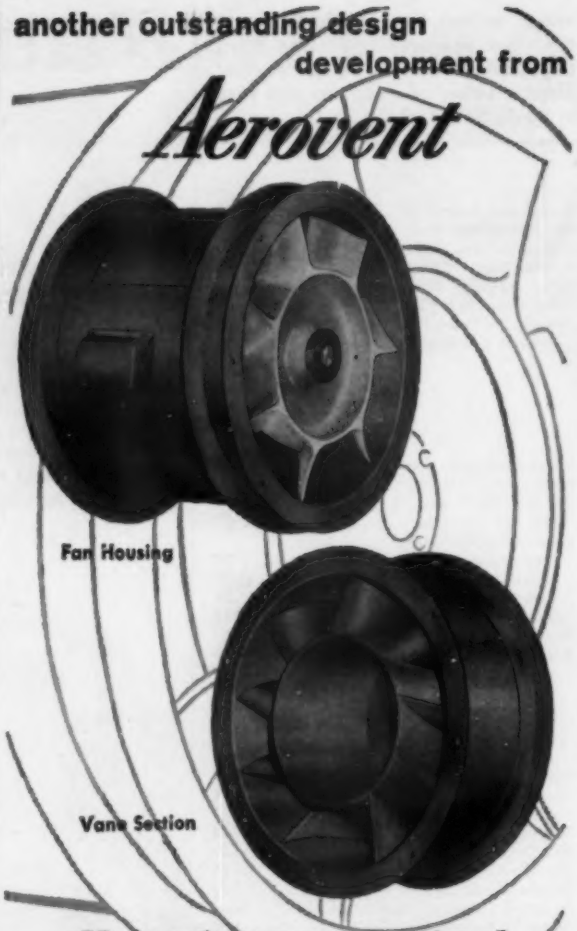
another outstanding design development from

Aerovent



direct-connected vaneaxial fans

with removable vane sections

Engineered for high-pressure, high-velocity air distribution systems, these units feature a unique removable vane section which simplifies installation and permits easy access for routine cleaning and maintenance.

Available in 30 models in sizes 18" to 48" for capacities from 3230 to 67,300 cfm with special design features for all application requirements.

Write for Bulletin 475

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

CERTIFIED PERFORMANCE

Aerovent

FAN COMPANY, INC.

ASH AND BOND STREETS — PIQUA, OHIO

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Quick delivery of the Drive you need!

Typical final assembly
of A-S Drives from completed sub-assemblies

When you purchase a Square D A-S Drive, you get a complete "package"—including drive motor, operator's station and all controls. You also get these important advantages:

QUICK DELIVERY • Square D's unique method of stocking sub-assemblies means quicker deliveries of packaged drives to meet your requirements.

EASY INSTALLATION • Maintenance manuals are complete in every detail, including step-by-step installation instructions. Moreover, each **A-S Drive** is completely factory-tested and adjusted when shipped — only a few trimming adjustments are needed to put it in operation.

MINIMUM MAINTENANCE • Industrially rated components are used throughout, and extra-sturdy cabinets give lasting protection. Static elements and encapsulated circuits — which are virtually maintenance-free — are utilized wherever possible.

EXTRA SAFETY • Only push buttons with heavy-duty construction and potentiometers with industrial clearances are used in operator's stations, for maximum personnel safety.

WIDE VARIETY AVAILABLE • There's a Square D "package" for *any* adjustable-speed job. You can choose from electronic, magnetic amplifier or motor-generator types — with ratings from 1/20 to 400 hp — and with accuracies to within fractions of 1%.

FIELD APPLICATION HELP • Square D has wide experience in the design and manufacture of adjustable-speed drives, and field specialists are trained to help you in the selection of the proper drive.

Write FOR BULLETIN • *Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin*

SQUARE D COMPANY

wherever electricity is distributed and controlled

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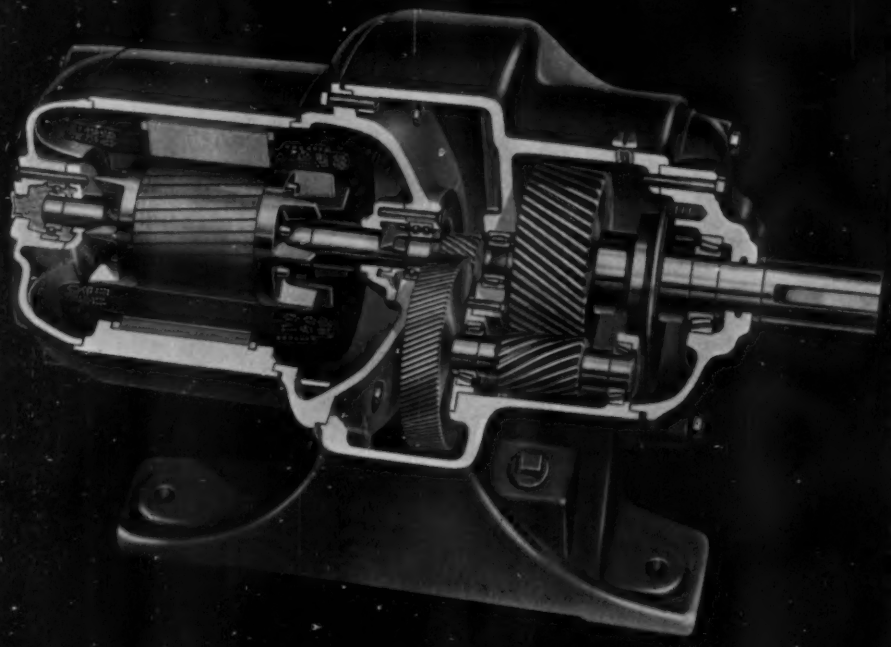
designed for LONG LIFE ...life-long dependability

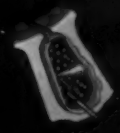
Only U.S. SYNCROGEAR has all these features...



RUGGED PYRAMIDAL CASE prevents distortion or misalignment.

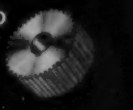
SOLID SHANK BUILT-IN PINION can't vibrate or work loose.

ASBESTOS PROTECTED WINDINGS will not deteriorate from heat.

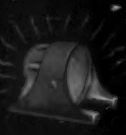


ONE-PIECE SUPPORTING CASE assures permanent alignment of gears, pinions.

THROUGH-HARDENED GEAR TEETH give greatest strength, longest wear.

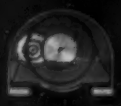


NORMALIZED CASTINGS prevent warping, misalignment of gears, shafts.

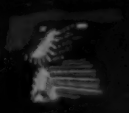


FRICTION-FREE OIL SEAL can't wear, prevents leakage.

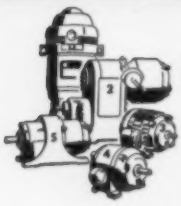
POSITIVE AUTO-LUBRICATION by slow-gear dip prevents churning



MICRO-SHAVED AND HONED GEAR TEETH provide smooth operation, long life.



U.S. SYNCROGEAR MOTORS offer the *most features* to provide long life and dependability. For a quarter-century, U.S. Syncrogears have led design progress. (Available 1/3 to 75 h.p.—single-, double-, triple-reductions, and worm-geared.)



U.S. MAJOR MOTOR LINES INCLUDE:
1. Vertical Solid & Holloshaft, 2. Varidrive, 3. Totally-Enclosed, 4. Uniclosed, 5. Syncrogear. Also, many other special motors.

FREE SYNCROGEAR BROCHURE No. F-1880
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